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ENCYCLOPÆDIA BRITANNICA.

D I A

Dialogism
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Dialogue.

DIALOGISM, in *Rhetoric*, is used for the soliloquies of persons deliberating with themselves.

DIALOGUE, in literature and in common life, a conversation between two or more persons, and either written or oral.

As the end of speech is conversation, no kind of writing can be more natural than dialogue, which represents this. Accordingly we find it was introduced at a very early period; for there are several instances of it in the Mosaic history. The ancient Greek writers, especially the philosophers, also fell very much into dialogue, as the most convenient and agreeable method of communicating their sentiments and instructions to mankind. And indeed it seems to be attended with very considerable advantages, if well and judiciously managed; for it is capable of rendering the driest subjects entertaining and pleasant, by its variety, and by the different characters of the speakers. Besides, things may be canvassed more minutely, and many lesser matters, which serve to clear up a subject, may be introduced with better grace, by means of questions and answers, objections and replies, than can be conveniently done in a continued discourse. There is likewise a further advantage in this way of writing, that the author is at liberty to choose his speakers; and therefore, as Cicero has well observed, that when we imagine that we have persons of an established reputation for wisdom and knowledge talking together, this circumstance necessarily adds a weight and authority to the discourse, and more closely engages the attention. The subject-matter of dialogue is very extensive; for whatever is a proper argument of discourse, public or private, serious or jocose—whatever is fit for wise and ingenious men to talk upon, either for improvement or diversion—is suitable for a dialogue.

From this general account of the nature of dialogue, it is easy to perceive what kind of style best suits it. Its affinity with epistles shows there ought to be no great difference between them in this respect. Indeed, some have been of opinion that it ought rather to sink below the style of an epistle, because dialogues should in all respects represent the freedom of conversation, whereas epistles ought sometimes to be composed with care and accu-

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racy, especially when written to superiors. But there seems to be little weight in this argument, since the design of an epistle is to say the same things, and in the same manner, as the writer judges would be most fit and proper for him to speak if present; and in a dialogue the design is similar with respect to the several persons concerned in it. Upon the whole, therefore, a plain, easy, and simple style, suited to the nature of the subject, and the particular characters of the persons concerned, seems to be alike suitable to both.

But as greater skill is required in writing dialogues than letters, we shall give a more particular account of the principal things necessary to be regarded in their composition, and illustrate them chiefly from Cicero's excellent dialogues concerning an orator. A dialogue then consists of two parts; an *introduction*, and *the body of the discourse*.

The *introduction* acquaints us with the place, time, persons, and occasion of the conversation. Thus Cicero places the scene of his dialogues at the country seat of Crassus; a very proper retreat, both for such a debate and the parties engaged in it. And as they were persons of the first rank, employed in the greatest affairs of the state, and as the discourse occupied them for two days, he represents it to have happened at the time of a festival, when no business was done at Rome, and an opportunity was thus afforded them of being absent.

And because the greatest regard should be had in the choice of the persons, who ought to be such as are well acquainted with the subject upon which they discourse, in these dialogues of Cicero the two principal disputants are Crassus and Antony, the greatest orators of that age, and therefore the most proper persons to dispute respecting the qualifications essential for their art. One would think it scarcely necessary to observe that the conference should be held by persons who lived at the time, and thus were capable of conversing together. But yet some good writers have run into the impropriety of feigning dialogues between persons who had lived at distant times. Plato adopted this method, in which he has been followed by Macrobius. But others, who have been willing to bring persons to discourse together who lived in different ages, without such incon-

Dialogue. sistency, have written dialogues of the dead. Lucian has made himself most remarkable in this way. As to the number of persons in a dialogue, they may be more or fewer; so many as can conveniently carry on a conversation without disorder or confusion, or they may be only two. Some of Cicero's dialogues have but two, others three or more, and those concerning an orator seven. But it is convenient in some respects that they should all be persons of different characters and abilities; a circumstance which contributes both to the variety and beauty of the discourse, like the different attitudes of figures in a picture. Thus, in Cicero's dialogues last mentioned, Crassus excelled in art, Antony principally by the force of his genius, Catullus by the purity of his style, Scevola by his skill in the law, Cæsar by wit and humour; and Sulpitius and Cotta, though young men, were both excellent orators, yet they differed in their manner. But there should be always one principal person, having the main part of the conversation; like the hero in an epic poem or a tragedy, who excels the rest in action, or the principal figure in a picture, which is always made the most conspicuous. In Plato's dialogues this is Socrates, and Crassus in those of Cicero above mentioned.

It is usual likewise, in the introductions, to acquaint us with the occasion of the discourse. Indeed this is not always mentioned; as in Cicero's dialogue concerning the parts of oratory, where the son begins immediately with desiring his father to instruct him in the art. But it is generally taken notice of, and most commonly represented as accidental; the reason of which may be, that such discourses appear most natural, and may likewise afford some kind of apology for the writer in managing his different characters, since the greatest men may be supposed not always to speak with the utmost exactness in an accidental conversation. Thus Cicero, in his dialogues concerning an orator, makes Crassus occasionally fall upon the subject of oratory, in order to divert the company from the melancholy thoughts of what they had been discoursing of before, with relation to the public disorders, and the dangers which threatened their common country. But the introduction ought not to be too long and tedious. Mr Addison complains of this fault in some authors who employ dialogue. "For though," as he says, "some of the finest treatises of the most polite Latin and Greek writers are in dialogue, as many very valuable pieces of French, Italian, and English, appear in the same dress; yet in some of them there is so much time taken up in ceremony, that, before they enter on their subject, the dialogue is half over."

We come now to the *body* of the discourse, in which some things relating to the persons, and others to the subject, are proper to be remarked.

And as to the *persons*, the principal thing to be attended to is to keep up a justness and consistency of character throughout the whole. And the distinct characters ought to be so perfectly observed, that even from the very words it may be always known who is the speaker. This renders dialogue more difficult than single description, by reason of the number and variety of characters which are to be drawn at the same time, and each of them managed with the greatest propriety. The principal speaker should appear to be a person of great sense and wisdom, and best acquainted with the subject. No question ought to be asked him, nor objection started, but what he should fairly answer; and all that is said by the rest should principally tend to promote his discourse, and carry it through in the most artful and agreeable manner. When the argument is attended with difficulties, one other person or more, of equal reputation, or nearly so, but of different sentiments, should be introduced to oppose him, and maintain the

contrary side of the question. This affords an opportunity for a thorough examination of the point on both sides, and for answering all objections. But if the combatants are not pretty equally matched, and masters of the subject, they will treat it but superficially. Through the whole debate, however, there ought not to be the least wrangling, peevishness, or obstinacy; nothing indeed but the appearance of good humour and good breeding, together with a readiness to submit to conviction and the force of truth, according as the evidence shall appear to be on one side or the other. In Cicero, these two characters are Crassus and Antony; and from them Mr Addison seems to have taken his Philander and Cynthio in his *Dialogues upon the Usefulness of Ancient Medals*, which are formed pretty much upon Cicero's plan. When younger persons are introduced, or such as are not equally acquainted with the subject, they should rather be inquisitive than disputative; and the questions they ask should be neither too long nor too frequent, in order that they may not too much interrupt the debate, nor appear over talkative before wiser and more experienced persons. Sulpitius and Cotta sustain this character in Cicero, and Eugenius in Mr Addison. It is very convenient, however, that there should be one person of a witty and jocose humour, to enliven the discourse at proper seasons, and render it the more entertaining, especially when the dialogue is drawn out to any considerable length. Cæsar performs this part in Cicero; and in Mr Addison, Cynthio, a person of a similar turn, opposes Philander in a humorous way. Mr Addison's subject admitted of this; but the seriousness and gravity of Cicero's argument required a different speaker for the jocose part. Many persons ought not to speak immediately after one another; though Scaliger and others think a fourth person may sometimes be permitted to speak in the same scene without confusion. However, if this is not commonly allowed upon the stage, where the actors are present, and may be distinguished by their voice and habit; much less should it be so in a dialogue, where we have only their names to distinguish them.

With regard to the *subject*, all the arguments should appear probable at least, and nothing should be advanced which may seem weak or trivial. There ought also to be an union in dialogue, in order that the discourse may not ramble, but keep up to the main design. Indeed, short and pleasant digressions are sometimes allowable, for the ease and entertainment of the reader; but every thing should be so managed that he may still be able to carry on the thread of the discourse in his mind, and keep the main argument in view, till the whole be finished. The writers of dialogue have not confined their discourses to any certain space of time, but either concluded them with the day, or broken off when their speakers have been tired, and resumed them again the next day. Thus Cicero allows two days for his three dialogues concerning an orator; but Mr Addison extends his to three days, allowing a day for each. But the same method has not always been observed in composing dialogues; for sometimes the writer, by way of narrative, relates a discourse which passed between other persons. Such are the dialogues of Cicero and Mr Addison last mentioned, and many others both of the ancients and moderns. But at other times the speakers are introduced in person as talking to each other. This, as Cicero observes, prevents the frequent repetition of those words, "he said," and "he replied;" and by placing the hearer, as it were, in the conversation, gives him a more lively representation of the discourse, and thus makes it the more affecting. In this manner, therefore, Cicero wrote his *Dialogue of Old Age*, in which Cato, who was then advanced in years, recounts the satisfaction of life which may be enjoyed in old age; and, in fact, he tells his friend

Dialogue.

Dialthæa
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Diamond.

Atticus he was himself so affected with that discourse, that when he reviewed it, he sometimes fancied they were not his own words, but Cato's. There are some other dialogues of Cicero written in the same way; and both Plato and Lucian generally chose this method.

DIALTHÆA, in *Pharmacy*, an unguent formerly much used as a resolvent, and so called from *Althæa*, or marshmallows, which is the principal ingredient in it.

DIALYSIS, in *Grammar*, a mark or character, consisting of two points placed over two vowels of a word, in order to separate them, because otherwise they would make them a diphthong, as *Mosæic*, &c.

DIAMASTIGOSIS, a festival at Sparta in honour of Diana Orthia, which received that name *απο του μαστιγουν*, from *whipping*, because boys were whipped before the altar of the goddess. These boys, called Bomonicæ, were originally free-born Spartans, but in the more delicate ages they were of mean birth, and generally of a servile origin. This operation was performed by an officer, in a severe and unfeeling manner; and, that no compassion should be raised, the priest stood near the altar with a small light statue of the goddess, which suddenly became heavy and insupportable if the lash of the whip was more lenient or less rigorous than necessary. The parents of the children attended the solemnity, and exhorted them not to commit any thing, either by fear or groans, that might be unworthy of Laconian education. These flagellations were so severe that the blood gushed profusely, and many expired under the lash, without uttering a groan or betraying any marks of fear. Such a death was reckoned very honourable; and the corpse was buried with much solemnity, with a garland of flowers on its head. The origin of this festival is unknown. Some suppose that Lycurgus first instituted it in order to inure the youth of Lacedæmon to bear labour and fatigue, and to render them insensible to pain and wounds. Others maintain that it is a mitigation of an oracle, which ordered that human blood should be shed on Diana's altar; and, according to their opinion, Orestes first introduced this barbarous custom, after he had brought the statue of Diana Taurica into Greece. There is another tradition which mentions that Pausanias, as he was offering up prayers and sacrifices to the gods before he engaged with Mardonius, was suddenly attacked by a number of Lydians, who disturbed the sacrifice, and were at last repelled with staves and stones, the only weapons with which the Lacedæmonians were provided at that moment. In commemoration of this, therefore, the whipping of boys was instituted at Sparta, and thereafter the Lydian procession.

DIAMETER, in *Geometry*, a right line passing through the centre of a circle, and terminated at each side by the circumference. See *GEOMETRY*.

DIAMOND, *adamas* of the ancients, *almas* of Persia, and *heera* of Hindustan, is the most brilliant of gems; and although known from the remotest times, if we may judge by the casual notice made of it in Scripture, it had in the earlier periods of history obtained little more than a name. Pliny states that it bore a price *above all things in the world*, and was known to very few except princes and crowned heads. His meagre remarks on this gem are even less satisfactory than those upon almost any other; which affords another reason to conclude that the diamond still remained in his time an object of great rarity. The localities quoted by Pliny appear to be quite erroneous, at least subsequent observations give us reason to think so.

Up to the commencement of the eighteenth century diamonds were wholly derived from India, where they were found in detached crystals, accompanied with grains of gold, amongst metallic sand washed down from surrounding mountains. In 1728 a similar territory, loaded with

the two most valuable substances in nature, was discovered on the southern continent of the New World. When in pursuit of gold, crystals of diamond were often found; but the labourers being ignorant of their value, laid them aside as curiosities. A miner, who is said to have arrived in Brazil at this time, first directed attention towards them; and, without attempting to appropriate his discovery to his own aggrandisement, he led his comrades to turn their pursuit to the more engaging object. It soon, therefore, attracted the notice of the government, and was shortly afterwards taken possession of in name of the sovereign.

Hitherto the supply of diamonds was entirely confined to Hindustan and the island of Borneo; and, as might reasonably be expected, the opening of a new field, the extent of which was as yet wholly unknown, could not fail to affect the market. The discredit which was at first thrown upon the accounts from Brazil, as also on the purity and perfection of the stones, repressed the fears of the Asiatic dealers, and the increased demand after the purchase of the Pitt diamond, a circumstance which no doubt rendered that gem far more *recherché* at the gay and luxurious court of France, all tended to increase the demand, and keep it more upon an equilibrium with the increased supply than could possibly have been expected. At a subsequent period, no doubt, the revolution of France interfered with the value of jewels; but the surplus thus produced was soon absorbed by the wealth of Britain, and diamonds of the first water for a long time maintained their ground.

At the present day this perhaps cannot be said to hold good. As a commercial commodity, diamonds must have suffered depression like all others, and may perhaps be valued at from twenty-five to thirty per cent. particularly those beyond the smallest sizes, under the prices which they bore in the times of Tavernier; although Mawe appears to have been anxious to inculcate a different doctrine. After his examination of the Brazilian district, he says there would be no difficulty in calculating the period requisite to work out the whole of the diamond ground in that country; and as many of the mines of Hindustan are considered as exhausted, the period must come sooner or later when diamonds will be no longer to be had.

In both countries the gem is confined within the limits of the tropics. In India, Golconda has always been cited as one of its principal repositories, although none was ever found in the immediate vicinity of that fortress, from the circumstance perhaps of the geological character of the neighbourhood, which is entirely syenitic. It may have arisen, however, from the fact, that the diamond mines of Raolconda and Ganee Purteeal were situated in the territory of the Kootub Shahee kings of Golconda. When that dynasty was overthrown, and their country occupied by the officers of the Mogul emperors, Golconda ceased to be the capital, and Hyderabad, which is only a few miles distant, became the occasional seat of the new government. The territory in which the mines are situated has since been ceded to the East India Company. It lies near Condapilly, on the northern bank of the Kistna, about fifty miles from the sea, and near the Pass of Bezoara, where the river appears at some period to have forced its way through a chain of hills, and to have emptied an extensive lake which had existed to the westward of them. All attempts to work them have been abandoned, as the produce has ceased to refund the expense of labour. The localities of the diamond in Hindustan are so various that it would be almost endless to enumerate them. Those on the Mahanuddy, with those on the Kistna and at Mallavilly, north-west of Ellore, may be mentioned as probably the most productive of this beautiful gem. The island of

Diamond.

Diamond. Borneo is the only other eastern locality which can boast of its production. It occurs at Pontiana, in that island, directly under the line, and at Benjarmassin, about three degrees south of the equator. Here it is said to be of a quality superior to that of the gems found in the other Indian localities, and to be distinguished in consequence by the name of *Landak*, the place they are found in. Here also the diamond occurs in alluvial soil, accompanied with gold. One diamond was found about a century ago, of 367 carats, supposed to be now in the hands of the chief of Pontiana.

From Heyne's account of the working of diamond mines in Hindustan, it seems to afford a very miserable livelihood. He states that the diamond has hitherto been found only in alluvial soil, or in the most recent rocks; and that the stones are not scattered through the whole of these beds, but confined to one rather harder than the rest. The upper stratum, of eighteen inches, consists of sand, gravel, and loam; next there is a deposit of stiff black clay or mud, of about four feet; and next the diamond bed, which is distinguished by a mixture of large rounded stones. It is from two to two and a half feet thick, closely cemented together with clay. Sometimes this stratum is covered with calcareous tuff. Here shallow pits are excavated, of a few feet in diameter, in such spots as the practice of the workman may induce him to select; he sinks to a depth of a few feet, and searches the bed which he considers most promising for his purposes, and if he meets with little encouragement, he shifts his situation, and proceeds elsewhere. Thus a great deal of the country may be turned to waste and neglected, and, when it comes to be again wrought over more carefully, may give rise to the absurd fancy of regeneration.

The miners, M. Voysey (*Asiatic Researches*, vol. xv. p. 120) says, are of opinion all over India, that the chips and small rejected pieces of former searchers actually increase in size, and in process of time become large diamonds; and he finishes his paper, by hoping that some future mineralogist would ascertain whether there were any foundation for the vulgar opinion of the continual growth of the diamond; particularly as he hoped at some future period to produce undeniable proof of the re-crystallization of amethyst, zeolite, and felspar, in alluvial soil. This respectable gentleman did not live to bring forward his proofs; but had he been doomed to arrive at the age of the patriarchs of old, we are of opinion he would have been puzzled to produce them.

In Brazil, the diamond is more confined to one spot than in India. The district of Minas Geraes comprehends, as far as we yet know, the whole of the diamond grounds hitherto discovered in the New World. There the workings appear to be carried on more systematically than in India. The operations at the Serra do Frio we have already described in the article BRAZIL (vol. v. p. 199). The Serra do Frio, or cold mountain, is a mountainous platform, having an elevation of from sixteen to eighteen hundred metres. The district over which the diamonds are searched for, extends about sixteen leagues from north to south, by about eight from east to west. It is situated twelve leagues north of Tejuco, on the river Tigitouhonha, which falls into the river San Francisco. By the decomposition of the granite, an agglomerate is formed, composed of rounded white quartz pebbles, and light-coloured sand, to which the natives give the name of *cascalho*; and it is in this substance that the diamonds are found, along with gold, which is sometimes crystallized. It is exactly similar to some of the samples of the diamond deposits of Hindustan sent to the Royal Society of Edinburgh by Mr Swinton, but differs considerably from others, where a conglomerated sandstone of considerable tenacity

has in several instances been sent, as the matrix of the diamond. **Diamond.**

From any thing we are yet able to judge, it does not appear that the diamond has ever yet been seen in a matrix which could be esteemed its original position. Heyne has given two coloured engravings of diamonds in the matrix, and they have the merit of representing very faithfully specimens of this description we have seen at home; but they are in all probability only diamonds accidentally agglutinated in ferruginous matter having no character of a rock. The Musnuddy, which joins the Mahanuddy, is mentioned as affording an indication which might lead to a favourable result in such an investigation. At its confluence with the Maund River, near Chunderpoor, and not farther down than Sonpoor, it is only on the left bank of the river that diamonds are found. Hence the Maund is the point at which the examination should commence; and if the country can be effectually penetrated, it would be well worthy the attention of some enterprising mineralogist.

We have no satisfactory geological account of any of the diamond countries; a slight sketch by Voysey, in the article above quoted, is the best that we can refer to. He particularly alludes to a range of hills, called the Nalla Malla, or Blue Mountains, about Cummum, on the Gunlacummum river, which are composed of schistose rocks, of all varieties, from clay-slate to pure limestone, accompanied with quartz rock, sandstone, sandstone breccia, flinty slate, hornstone slate, and a tuffaceous limestone, containing imbedded, rounded, and angular masses of all these rocks. These are bounded on all sides by granite, which appears to pass under and form the base. The only rock of this formation on which the diamond is found is the sandstone breccia. "I have as yet," says he, "only visited the rich mines of Banaganpilly (lying in Heyne's map in $78^{\circ} 4'$ by $15^{\circ} 4'$), where the breccia is found under a compact sandstone rock, differing in no respect from that which is found under other parts of the main range. It is composed of a beautiful mixture of red and yellow jasper, quartz, calcedony, and hornstone, cemented together by a quartz paste. It passes into puddingstone, composed of rounded pebbles of quartz, &c. cemented by an argillo-calcareous earth, of a loose friable nature, in which the diamonds are most frequently found."

Heyne states, that in some of the mines in India the diamonds are found entirely broken or crushed, and only of value for pounding; but at the same time thinks it must be owing to carelessness. He mentions also that the diamonds of Cuddapah are carried to Madras to be used for the same purpose, and the price he quotes for a carat of stones fit for brilliants is only seven rupees.

No crystal in nature is more beautiful than that of the diamond. It is sometimes so pure and so pellucid, with its angles and faces so perfectly symmetrical, as to shine like a dew-drop in the rays of the sun. Its primitive form is that of the equilateral octahedron. It passes into the dodecahedron and the cube, presenting modifications in each. The colourless diamond of the first water is the most valuable; but very fine diamonds sometimes present a deep red tinge, also yellow, orange, green, blue, and black. Those which have a slight tint of yellow are often remarkably brilliant, and are said to be of a superior hardness.

The value of diamonds is always calculated in carats, which consists of four grains; but it must be remembered, that the diamond grain differs from the Troy grain, as it takes five of the former to weigh four of the latter, or more exactly one carat = 3.174 gr. Troy.

In valuing diamonds, either rough or cut, the practice is to take the weight in carats, to square that weight, and

Diamond. then to multiply the product by such a rate of price as may correspond to the state and quality of the stone; thus, if a natural crystal of diamond be clear, without flaws, and of a favourable shape, the price by which the square of its weight should be multiplied is L.2; so that if the stone weigh one carat, its value will be L.2, if two carats, $2 \times 2 = 4$, and $4 \times 2 = 8$, or a stone of two carats is worth L.8. A stone of ten carats, in the same way, will give $10 \times 10 = 100$, and $100 \times 2 = L.200$, the value of a perfect rough diamond of this weight.

If the diamond has been worked into a brilliant of just proportions, the same rule is observed of squaring the weight in carats; but a much higher price is used as the multiplier of the product; as L.8 is considered to be the proper multiplier when the stone is perfect in water and shape. Thus a diamond of $5\frac{1}{2}$ carats gives $30\frac{1}{4}$ as its square, and this multiplied by 8 makes L.242 as its price. If the stone has been worked into the form which is termed a rose, L.6 is used as the multiplier; and if it be of the form termed table-cut, it is still lower.

Considerable modifications, however, must be made in these multipliers, according to the quality of the diamonds and the state of the market. If a brilliant be what is termed "off colour," that is, not absolutely colourless, or if it be in any other way imperfect in shape or purity, a corresponding diminution must be made in the multiplier. Thus a brilliant with a yellow or a milky hue, or with a small speck or flaw, may not be multiplied by more than L.4, L.5, or L.6, according to the nature or extent of the imperfection. The state of the demand in the market must likewise have great influence. At present the demand for good brilliants of one carat and under is greater in proportion to the supply than for heavier stones, and such stones will therefore sometimes cost L.10 the carat; whilst there being fewer purchases for the larger sizes, they may often be had in commerce at a lower rate than has been mentioned above.

The finest known diamonds are as follow:

That of the crown of France (Pitt diamond), weighing $136\frac{3}{4}$ carats, the value of which, taken according to the above rule, would be L.141,058. The dimensions of this fine stone are stated to be,

Length 1.2437 inches.

Breadth 1.177

Depth859

Weight in Troy grains, 434.

That of the Grand Duke of Tuscany (now Austrian), weighing $139\frac{1}{2}$ carats, valued as above at L.153,682.

That of the Emperor of Russia, weighing 195 carats. This diamond is rose cut.

That of the Great Mogul, weighing $279\frac{9}{16}$ carats, also rose cut.

That of the King of Portugal, weighing 1680 carats, being rough, not less than L.5,644,800.

It is consequently quite evident that this rule can obtain only among diamonds of moderate size; and if it should establish something by which a price may be named, all else must be left to subsequent arrangement.

Of the remarkable diamonds we have enumerated, the first is that known by the name of the Regent or Pitt diamond. It was found at Pasteal, in the Golconda district. It was imported into this country by Mr Pitt, governor of Madras, who purchased it from a native for 48,000 pagodas, about L.20,400 at the exchange of the day, and after being offered to different crowned heads in Europe, was purchased by the regent of France in 1717 as a jewel for the crown. It was placed by Napoleon in the hilt of the sword of state, and, according to Brard, the price paid for it was 2,250,000 francs; Jeffreys calls it L.125,000, and other authors say L.130,000. Any of these, however, although

by much the largest price ever paid for any jewel, is not equal to the rule of value. This is esteemed the finest and most perfect diamond known.

The second was purchased for a bit of rock-crystal, on a stall in the market-place of Florence, at the cost of a few pence; it is of a beautiful lemon-yellow colour, and is now in the possession of the house of Austria. The diamond mentioned as the property of the Emperor of Russia ornaments the top of his sceptre. It is of the size of a pigeon's egg, and is said to have been the eye of an Indian idol pillaged by a deserter from the French service, who had the address to get himself installed as a priest in the service of the Malabar deity at Seringham, as narrated by Dutens. The Empress Catherine purchased it for L.90,000, together with an annuity of L.4000.

The Great Mogul is described by Tavernier as an irregularly-shaped diamond, but cut and polished. It was found at Colore, in the district of Golconda, in the year 1550; and is said to have weighed 900 carats before cutting, but this appears a most enormous sacrifice. Of the Brazilian diamond some suspicions have been entertained. It has been insinuated that it is only a mass of very fine white coloured topaz, and it is not likely that the king of Portugal will run the hazard of ascertaining the fact.

The supply of diamonds from Brazil, according to Baron d'Eschwege, during the eighty-four years from 1730 to 1814, was at the rate of 36,000 carats per annum; but the return from the registers of the administration of the diamond mines from 1800 to 1806 was only 19,000 carats. It is also added, that the revenue derived by government during the first period was only eighteen or nineteen francs the carat, whilst from forty to fifty were obtained during the last; a certain indication of a diminished supply. A singular circumstance is noticed with respect to the uniformity of the diamond ground of Do Frio. The same cubic mass of cascalho will yield, on washing, pretty nearly the same number of carats, in large or small diamonds, so that the superintendent can calculate on the probable produce of the washing.

Large stones do not abound in Brazil, but there are some of considerable dimensions. Mawe mentions one from the little rivulet D'Albaite of 120 carats, but they do not often exceed from eighteen to twenty.

The prices of diamonds quoted by Heyne, who visited with a scrutinizing eye the principal mines of Hindustan, differ from those laid down by the rule of Tavernier and Jeffreys. Without attempting to reconcile them, we shall quote the value which the Hindus put upon what they consider as the best, and denominate the Brahma diamond; it is sold by the manjalin, which is equal to two carats, and each carat at the price of ten pagodas.

One manjalin 10 Madras pagodas.

Two 24

Three 40

Four 80

Five 100

Six 150

Seven 250

Eight 400

He adds that these are the prices of stones free from speck, flaw, or crack. Cut stones are valued in a different way.

The most remarkable circumstance in the history of the diamond is to be found in the nature of its composition. This proud, this imperial ornament, which has ever occupied the summit of the diadem, this most brilliant of gems, and hardest of all known bodies, is, after all, but a morsel of charcoal, which has been made to yield to the rays of the sun, and dissolve into a noxious vapour. As early as 1607, Bætius de Boodt threw out the hint that

Diamond. diamond was inflammable. In 1673 Boyle discovered that when it was exposed to a great heat it was dissipated into acrid vapour. In 1694, the experiments of Boyle were confirmed by those of Cosmo III. Grand Duke of Tuscany, with his celebrated burning glass. About the same time, but whether before or not is uncertain, Sir Isaac Newton was led, from the great refractive power of the diamond, to pronounce it "an unctuous substance coagulated." Lavoisier proved it to be composed of carbon, by throwing the sun's rays concentrated by a powerful lens upon a diamond inclosed in a vessel with oxygen gas; when the diamond and the oxygen disappeared, and carbonic acid was generated. Sir George Mackenzie repeated the experiments of Boyle in 1800; and, finally, when Sir Humphry Davy visited Florence in 1814, the experiment of the grand duke was performed again with the same lens; and mineralogists no longer hesitated to place the gem amongst inflammable bodies.

According to Ellicot, the specific gravity of Brazil diamonds is 3.513, and of India diamonds 3.519. The former is the mean of four, the latter of ten experiments.

Diamond cutting was little understood till 1476, when an artist of the name of Berghen, residing at Bruges, introduced the practice of using diamond powder for forming and polishing the facets. Holland, in consequence, long maintained a monopoly of this trade; and to this day the smaller diamonds are almost entirely manufactured for the European market, at Amsterdam. The Pitt diamond was, however, cut and polished in London, as most of the larger sized stones continue to be. It is a very laborious and tedious operation. The grinding into the required form is entirely done by the hand. Two stones are cemented to the ends of tool handles, and rubbed with a powerful pressure against each other, a leaden model being first taken of the rough stone intended to be cut. The faces are thus determined. The two stones are then rubbed together over a little metal box having a double bottom, the upper one being loose and perforated with small holes, through which the diamond dust passes, and is carefully preserved. The desired form being thus obtained, the dust is afterwards used in polishing the faces of the diamond, mixed up with sweet oil, on a common lapidary's wheel, and the brilliancy of the gem brought out. The period of constant work required to reduce a stone of between twenty-four and thirty carats to a regular form will extend to at least seven or eight months constant work. The Pitt diamond was said to occupy two years. From the outline in Plate CCII. fig. 1, there was a great deal of extraneous matter to reduce, and that space of time may very likely have been required. When the mass to be removed is of such a size as to render it of importance to keep it entire, the piece is cut off by means of a steel wire, extended on a bow of cane or whalebone, anointed with diamond powder. This process is very commonly adopted in India. The diamond is sometimes also split by means of a chisel under a sharp stroke of a hammer; but this means requires great firmness of mind and dexterity of hand, for a valuable stone is sometimes destroyed by an unlucky blow.

The forms into which the diamond is cut are the brilliant, the rose, and the table. The first is composed of a principal face, which is called the table, surrounded by a fringe composed of a number of facets, which is all that is visible above the bezil when set. The proportion for the depth should be half the breadth of the stone, terminated with a small face, parallel to the table, and connected with the surface by elongated facets. As the octahedron is the most common natural form of the stone, and the brilliant cut being by far the most advantageous in point of effect, and the most economical form that can be

adopted, it is hence preferred. The others are suggested *Diamond.* by the shape of the mass.

The rose is entirely covered with facets on the surface, and is flat below. The table form is adopted in consequence of the shape of the mass, whether crystal or fragment, and produces the least effect. It is principally used in India, where the native jewellers cleave stones into plates, having often a large surface with little proportioned weight or brilliancy, except at the edges, which are ornamented by being cut into facets. The great diamond of the Mogul emperor, called Derriah Noor, is of this description; that called Koh-é-noor is rose-cut.

Much of the value of diamonds depends on the cutting of the stone. A late celebrated philosopher, who required a piece of diamond for philosophical purposes, found a large mass in the hands of a jeweller. It was of an awkward form, and presented a flaw which very greatly deteriorated its value, as, in consequence of the refraction and reflection which took place within the mass, the flaw seemed to occupy nearly the whole of the interior. The gentleman, however, was not afraid. He paid a large sum for the stone, directed the workman in cutting it, amputated the piece he wanted, separating the flaw, and sold the remainder back to the jeweller, after being properly cut and polished, for double the price he paid for it.

Hopes were recently excited, that a new diamond district had been discovered in Siberia by the celebrated traveller Humboldt. He thought he had met with appearances in a territory belonging to Count Demidoff, analogous to that of Minas Geraes, and recommended a search for the gem. But as two years have since elapsed without any confirmation of this suggestion, the old localities of Asia and Brazil are likely to remain without competition.

Explanation of the Plate, No. CCII.—The three figures at the top, No. 1, 2, 3, are representations of the Regent or Pitt diamond, the Great Mogul, and the Grand Duke, of the full size and form. No. 4 presents the brilliant cut, looked at perpendicularly. No. 5, the same sidewise. No. 6 and 7 also represent the brilliant before it undergoes the process of re-cutting. No. 8 and 9 are the vertical and lateral appearances of the rose-cut diamond; and No. 10 and 11, that of the table-cut. The scale No. 12 exhibits the sizes of the set diamond within the bezil, together with the depth of the stone, and the number of carats a diamond of that size is likely to weigh. This estimate can only be an approximation to the exact weight; but the weight of a set stone may thus be very nearly ascertained. No. 13 is the figure of the octahedral diamond seen perpendicularly, with the table traced where the stone should be cut; and No. 14 is the same crystal seen laterally, with the table and the opposite face also traced. By these figures it will be seen how much more advantageous it is to adopt the brilliant form than any other.

Diamonds have been imitated with great success by the French artists. To this composition, to which they give the name of *strass*, they not only communicate the adamantine lustre of the zircon, but succeed in giving it such a similitude to the real stone in all respects, hardness excepted, that it is nearly impossible for unpractised eyes to detect the difference. Recently quartz has been used with great effect to form the faces of factitious stones.

DIAMOND used by Glaziers, is an instrument made of steel or iron, into the point of which a diamond is introduced and fixed by solder. Care must be taken to place the gem so that, by applying the instrument in a particular position, the angle of the crystal will come in contact with the glass.

DIAMOND, in Heraldry, a term used for expressing the black colour in the achievements of peerage.

Guillim does not approve of blazoning the coats of peers by precious stones instead of metals and colours; but the English practice allows it. Morgan says the diamond is an emblem of fortitude.

DIAMOND Harbour, a harbour in the western branch of the Ganges, on the Hooghly river, about thirty-four miles below Calcutta in a straight line, but much more by the windings of the river. Here the Company's ships generally unload, and take in great part of their homeward bound cargoes. There are mooring chains for their accommodation, and storehouses on shore; and in the adjacent villages, consisting of a few thatched houses, with some petty shops, provisions may be purchased. But the place is very unhealthy, especially during the periodical rains in July, August, and September, owing to the exhalations from the swamps, and the heavy dews which fall at night. The country on both sides of the river is infested with tigers.

DIAMOND Island is situated on the east side of the Bay of Bengal, twelve miles south from Cape Negrais. It is about a mile and a half long, by one mile broad; low, covered with wood, and surrounded by shoals, which render it dangerous for boats to land. It has fresh water, and abounds with turtle. It belongs to the Burmese, and is uninhabited. Long. 94. 12. E. Lat. 15. 51. N.

DIAMPER, a town of Hindustan, in the province of Cochin, said to be inhabited chiefly by Christians. Here a synod was held by the Portuguese archbishop and others, in the hopes of converting the Nestorians to the faith of the Roman Catholic church, but without effect. Long. 76. 37. E. Lat. 9. 55. N.

DIANA, the goddess of hunting. According to Cicero, there were three of this name; a daughter of Jupiter and Proserpine, who became mother of Cupid; a daughter of Jupiter and Latona; and a daughter of Upis and Glaucé. The second is the most celebrated, and to her all the ancients allude. She was born at the same birth as Apollo; and the pains which she saw her mother suffer during her labour gave her such an aversion to marriage, that she obtained permission of her father to live in perpetual celibacy, and to preside over the travails of women. In order to shun the society of men, she devoted herself to hunting, and was always accompanied by a number of chosen virgins, who, like herself, abjured the use of marriage. She is represented with a bow and quiver, and attended by dogs, and sometimes drawn in a chariot by two white stags. Sometimes she appears with wings, holding a lion in one hand, and a panther in the other, with a chariot drawn by two heifers, or two horses of different colours. She is represented as tall; her face has something manly in it; her legs are bare, well shaped, and strong; and her feet are covered with a buskin worn by huntresses among the ancients. She received many surnames, particularly from the places where her worship was established, and from the functions over which she presided. She was called *Lucina*, *Ilythia*, or *Juno Pronuba*, when invoked by women in childbed; and *Trivia* when worshipped in the crossways, where her statues were generally erected. She was supposed to be the same as the moon and Proserpine or Hecate, and from that circumstance she was called *Triformis*; and some of her statues represented her with three heads, namely, those of a horse, a dog, and a boar. She was also called *Agrotera*, *Orithia*, *Taurica*, *Delia*, *Cynthia*, *Aricia*, and the like. She was supposed to be the same as the Isis of the Egyptians, whose worship was introduced into Greece along with that of Osiris under the name of Apollo. When Typhon waged war against the gods, Diana, to avoid his fury, metamorphosed herself into a cat. She is generally known in the figures representing her, by the crescent on her head, by the dogs which attend

her, and by her hunting habit. The most famous of her temples was that of Ephesus, which formed one of the seven wonders of the world. (See *EPHESUS*.) She was there represented with a great number of breasts, and other symbols, which signified the earth or Cybele. Though she was the patroness of chastity, yet she forgot her dignity in order to enjoy the company of Endymion; and the favours she granted to Pan and Orion are also recorded among the mythic scandal of antiquity. The inhabitants of Taurica were particularly attached to the worship of this goddess, and they cruelly offered on her altar all the strangers who suffered shipwreck on their coasts. Her temple in Africa was always served by a priest who had murdered his predecessor; and the Lacedæmonians yearly offered her human victims till the age of Lycurgus, who changed this barbarous custom for the sacrifice of flagellation. The Athenians generally offered her goats; and others a white kid, and sometimes a boar pig or an ox. Among plants, the poppy and the dittany were sacred to her. Diana, as well as her brother Apollo, had some oracles, among which those of Egypt, Cilicia, and Ephesus, are the best known.

DIANA'S BANK, or **DIANA'S SHOAL**, a small sandy islet in the Indian Sea, scarcely visible from the mast-head, its situation lying so low. Long. 151. 5. E. Lat. 15. 45. S.

DIANÆ ARBOR, or **ARBOR LUNÆ**, in *Chemistry*, the beautiful arborescent form of silver, dissolved in nitric acid, and precipitated by another metal; so called from its resembling the trunk, branches, and leaves of a tree.

DIANO, a city of Italy, in the Neapolitan province Principato Citeriore, containing 4146 inhabitants.

DIAPASON, in *Music*, a musical interval, which most authors who have written on the theory of music use to express the octave of the Greeks.

DIAPASON, among the musical instrument makers, a kind of rule or scale by which they adjust the pipes of organs, and cut the holes of hautboys, flutes, and the like, in due proportion for performing the tones, semitones, and concords, with precision.

DIAPASON Diaex, in *Music*, a kind of compound concord, of which there are two sorts; the greater, which is in the proportion of 10:3; and the lesser, in that of 16:5.

DIAPASON Diapente, in *Music*, a compound consonance in a triple ratio, as 3:9. This interval, says Martianus Capella, consists of nine tones and a semitone, nineteen semitones, and thirty-eight dieses. It is a symphony made when the voice proceeds from the first to the twelfth sound.

DIAPASON Diatessaron, in *Music*, a compound concord founded on the proportion of eight to three. To this interval Martianus Capella allows eight tones and a semitone, seventeen semitones, and thirty-four dieses. This is when the voice proceeds from its first to its eleventh sound. The moderns would rather call it the *eleventh*.

DIAPASON Ditone, in *Music*, a compound concord, whose terms are as 10:4, or as 5:2.

DIAPASON Semiditone, in *Music*, a compound concord, whose terms are in the proportion of 12:5.

DIAPENTE, in ancient music, an interval marking the second of the concords, and with the diatessaron an octave; in modern music it is called a *fifth*.

DIAPER, a kind of cloth on which are formed various figures, and which is chiefly employed for table-linen.

DIAPHANOUS, an appellation given to all transparent bodies, or such as transmit the rays of light.

DIAPHORETICS, among physicians, all medicines which promote perspiration.

DIAPHRAGM (*Diaphragma*), in *Anatomy*, a part vulgarly called the midriff, and by anatomists *septum trans-*

Diaphoresis *versum*. It is a strong muscular substance, separating the breast or thorax from the abdomen or lower venter, and serving as a partition between the abdominal and the thoracic viscera. (See ANATOMY, *Index*.) Plato, as Galen informs us, first called it *diaphragm*, from the verb διαφραττειν, to separate. Till his time it had been called φρενες, from a notion that an inflammation of this part produced frenzy, which is not more warranted by experience than another tradition, that a transverse section of the diaphragm with a sword causes the patient to die laughing.

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Diarbekir.

DIAPHORESIS (Διαφορησις), in *Rhetoric*, is used to express the hesitation or uncertainty of the speaker.

DIARBEKIR, a city of Asiatic Turkey, and capital of the pashalic of Diarbekir, situated on a mass of basaltic rock, which rises in an eminence on the western bank of the Tigris, the stream of that river flowing by the foot of this hill from north-east to south-west, as it makes a sharp bend in that direction from the northward. The form of the town is very nearly circular. It is about three miles in circuit, and is encompassed by a lofty thick wall of black stone. This wall, which is supposed to be a work of the Romans, is fortified by numerous round and square towers at irregular intervals, which being high, and strongly built of hewn stone, present an appearance of great strength. The most strongly fortified portion of the city is on the north, where the square towers are very thickly placed, and there is a long battery of guns mounted, pointing through covered embrasures; but the whole is now in a neglected and ruinous condition. The town is also environed by a ditch. The city has four gates, which lead to Mardin, to Asia Minor or Rumelia, to the mountains of Armenia and Koor-distan, and to the river. The citadel, standing about midway between the two last-mentioned gates, is thus in the north-east angle of the town, and, seated on the eminence of rock in that quarter, overlooks the stream of the Tigris below, and, by its elevation, commands the whole of the town. It is surrounded by a wall, is divided into many courts, and contains the palace of the pasha, which is rather a commodious than a splendid building. Attached to it are extensive stables and an open space, in which the horses and the horsemen are exercised. One of the places used as a stable presents the ruins of a handsome and noble edifice, with finely-constructed domes of brick-work, and a beautiful door with columns and pilasters, the remains, as Mr Buckingham observes, of an old Christian building. The citadel is now almost completely in ruins. There is a fine view of the town from this height. The houses are built of black basalt in the lower stories, and of dark-coloured brick in the upper ones; this, with a succession of flat terraces, gives a sameness and gloominess to the aspect of the town, which, however, is somewhat relieved by the view of the mosques, towers, and little garden-plots seen in different parts of the town. The houses present a handsome appearance, and many of them are elegant. Of the mosques seen from the citadel, there are fifteen with minarets, nine having circular shafts and galleries in the Mahommedan style, and the remaining six having square towers, after the manner of Christian churches. There are five other mosques with domes or cupolas only, and several smaller ones, making altogether twenty-five Mahommedan places of worship. Among the minarets of the mosques, some were observed by Mr Buckingham, to whose travels in Mesopotamia we are chiefly indebted for this account of Diarbekir, to be highly sculptured; and in several of the square towers were intermixed layers of red burnt brick, mixed with masonry of stone, after the manner of the Roman towers in the walls of Antioch. Amidst the ruins of the castle some fine arches of highly burnt bricks were also observed, which, from their form, as well as material, looked more like Ro-

man than Saracenic work. The bazars and baths contain brick work of a similar kind, which Mr Buckingham thinks is decidedly Mahommedan. Broken columns of black coral are seen scattered in different quarters of the town; and among these are several Ionic capitals of Greek origin. Of the Christian churches, the Armenians have two, one of them large and richly decorated, and the other smaller, but more tastefully adorned. The Catholics have one church, with a convent attached to it; the Syrians and the Greeks have also each a place of worship; and the Jews have a small synagogue for their service. There are upwards of twenty baths in the town, and about fifteen khans or caravanserais. The Khan Hassan Pasha is particularly fine; and in its lower court the corn-market is usually held. Its magazines within the piazza, which runs round this, are generally filled with goods. In the upper galleries are carried on several trades and manufactures. There are also convenient lodgings here for travellers; and there is an upper story, with apartments for the harems or families of those who may sojourn here, with kitchens, fire-places, and other domestic conveniences. The bazars are well supplied with goods of all descriptions, and during the hours of business are thronged with people. They are, however, narrow, crooked, and mostly roofed over with wood, being neither so regularly laid out, nor so well covered in, as they generally are in the large towns of Turkey. The manufactures of the town are chiefly silk and cotton stuffs, printed muslins, shawls, and handkerchiefs, morocco leather in skins of all colours, smiths' work in hardware, and pipes for smoking, made of the jasmin branch, covered with muslin, and embroidered with gold and silver thread. About 1500 looms are supposed to be employed in the weaving of stuffs; and there are about 300 printers of cotton, with as many manufacturers of leather in the skin, besides shoemakers, saddlers, and other workmen. There are 100 smiths, and 150 makers of ornamented pipe-stems, besides those who make the clay-bath, amber mouth-pieces, &c. European cloths are introduced here through Aleppo, as well as most of the glass-ware, which is of German manufacture; fine muslins, Cashmere shawls, spices, and drugs, are brought from India through Bagdad. The common manufactures for domestic uses are supplied at home, and provisions and fruit are abundant and cheap.

The governor of the pashalic and city of Diarbekir has the dignity of three tails, and is immediately dependent on the sultan. He has a force under him of 1000 men, of whom more than one half are Turkish cavalry, and the remainder Turkish and Albanian foot. There are, besides, several petty chiefs among the Turks and the Koords, who are bound, for certain privileges which they enjoy, to furnish each his contingent of troops on the pasha's requisition. The people, though accustomed to despotic rule, consider the government of the pasha as secure; though, according to Mr Buckingham, there were few Turkish towns in which there seemed to be more of personal liberty, competence, and comfort, among all classes of people.

From the circumstance of the walls and buildings of this city being constructed almost wholly of black stone, it is called by the Turks Kara Amid, or the Black Amid. Its ancient name was Amida; the name of Diarbekir proceeds chiefly from the Arabs, as the name of Amid is still used by the Turks in all their public writings. Amida was successively taken, retaken, and destroyed, in the ancient wars between the Persians and Romans. It was pillaged by Tamerlane in the year 1393; and successive sieges and captures followed by the Persian kings, until it was conquered and taken by Selim, the first sultan of the Osmanlee Turks, in the year 1515. In 1605 it again fell

Diarbekir.

Diarthro-
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under the power of Persia; but it was afterwards retaken by the Turks, under whose dominion it has since continued. General Gardanne computes the population at 80,000, Macdonald Kinneir at 38,000, and Mr Buckingham, the latest traveller, at 50,000. The great majority consist of Osmanlee Turks, who are soldiers, government officers, merchants, and mechanics. The Armenians, who are the next numerous class, amount to 1000 families. The Arab, Turkish, and Armenian followers of the Catholic communion number 500 families, the Syrian sect 400, and the Greeks about 50 families. Almost all the Jews have of late emigrated to Bagdad, Aleppo, or Constantinople. The inhabitants of Diarbekir are thought to be more fanatical in their hatred of Christians than in other parts of the empire. This place is 187 miles north-west of Mardin, 220 north-east of Orfah, and 350 north-east of Aleppo. Long. 39. 52. E. Lat. 37. 55. N.

DIARTHROSIS, in *Anatomy*, a kind of articulation or juncture of the bones, which, being pretty lax, affords room for a manifest motion. The word comes from *δια*, and *αρθρον*, *jointure*. It is opposed to *synarthrosis*, in which the articulation is so close that there is no sensible motion at all.

DIARY, a term sometimes used for a journal or day-book, containing an account of every day's proceedings.

DIASCHISM, among musicians, denotes the difference between the comma and enharmonic diesis, commonly called the *lesser comma*.

DIASTOLE, among physicians, signifies the dilatation of the heart, auricles, and arteries; and is opposed to the *systole*, or contraction of the same parts. See *ANATOMY*.

DIASTOLE, in *Grammar*, a figure in prosody by which a syllable naturally short is made long.

DIASYRMUS, in *Rhetoric*, a kind of hyperbole, being an exaggeration of some low and ridiculous thing.

DIATESSARON, among ancient musicians, a concord or harmonic interval, composed of a greater tone, a less tone, and one greater semitone; its proportion in numbers is as 4:3.

DIATONIC, in *Music*, a word compounded of the Greek preposition *δια*, signifying transition, and *τονος*, tension, is indifferently applied to a scale or gammut, to intervals of a certain kind, or to a species of music, whether in melody or harmony, composed of these intervals. Thus we say the *diatonic series*, a *diatonic interval*, *diatonic melody* or harmony. The diatonic scale forms the system of diatonic music, and consists of diatonic intervals.

DIBBLE, or DIBBER, a simple but useful instrument in gardening, used for planting all sorts of young plants or slips.

DICE, among gamesters, certain cubical pieces of bone or ivory, marked with dots on each of their faces, from one to six, according to the number of faces.

Sharps have several ways of falsifying dice; first, by sticking a hog's bristle in them, so as to make them run high or low as they please. Secondly, by drilling and loading them with quicksilver, which is found out by holding them gently by two diagonal corners, when, if false, the heavy sides will turn always down. Thirdly, by filing and rounding them. But all these ways fall very far short of the art of the dice-makers, some of whom are so dexterous this way that a gambling sharper will give any money for their work.

DICÆARCHUS, a scholar of Aristotle, who composed a great number of books, which were much esteemed. Cicero and his friend Pomponius Atticus valued him highly. He wrote a book to prove that men suffer more mischief from one another than from all evils besides; and the work which he composed concerning the republic of Lacedæmon was extremely honoured, and read every year be-

fore the youth in the assembly of the ephori. Geography was one of his principal studies, on which science there is a fragment of a treatise of his still extant, and preserved among the *Veteris Geographiæ Scriptores minores*.

DICHOTOMY, a term used by astronomers for that phasis or appearance of the moon in which she is bisected, or shows just half her disk. In this situation the moon is said to be in a quadrate aspect, or to be in her quadrate.

DICKER, in old writers, denotes the quantity of ten hides of skins of which twenty made a last; also ten pairs of gloves, ten bars of iron, and the like, are sometimes expressed by the term *dicker*.

DICKINSON, EDMUND, a celebrated English physician and chemist, was born in 1624. He studied and took his degrees at Merton College, Oxford; and in 1659 published his *Delphi Phœnicizantes*, in which he attempted to prove that the Greeks borrowed the story of the Pythian Apollo, and all that rendered the oracle at Delphos famous, from the Holy Scriptures, and particularly the book of Joshua; a work which procured him great reputation both at home and abroad. He practised physic first at Oxford; but removing to London in 1684, his good fortune in recovering the Earl of Arlington from a dangerous sickness procured his promotion as a physician in ordinary to Charles II. and to his household. As that prince understood and loved chemistry, Mr Dickinson grew into great favour at court, and was continued in his appointments under James II. After the abdication, he retired from practice, and died in 1707. He published many other things, *Physica vetus et vera*, containing a system of philosophy, chiefly framed on principles collected from the Mosaic history.

DICTATOR, a magistrate at Rome invested with regal authority. This officer was first chosen during the Roman wars against the Latins. The consuls being unable to raise forces for the defence of the state, because the plebeians refused to enlist if they were not discharged of all the debts which they had contracted with the patricians, the senate found it necessary to elect a new magistrate with absolute and uncontrollable power to take care of the state. The dictator remained in office for six months, after which he was again elected if the affairs of the state seemed to be desperate; but if tranquillity was re-established, he generally resigned his power before the time had expired. He knew no superior in the republic, and even the laws were subjected to him. He was called dictator, because *dictus*, named by the consul, or *quoniam dictis ejus parebat populus*, because the people implicitly obeyed his command. He was named by the consul in the night, *viva voce*, and his election was confirmed by the augurs. As his power was absolute, he could proclaim war, levy forces, conduct them against an enemy, and disband them at his pleasure. He punished as he pleased, and from his decision there lay no appeal, at least till later times. He was preceded by twenty-four lictors with the *fusces*; and during his administration, all other officers, except the tribunes of the people, were suspended. In short, he was the master of the republic. But amidst all this independence he was not permitted to go beyond the borders of Italy; he was always obliged to march on foot in his expeditions; and he never could ride in difficult and laborious marches without previously obtaining formal leave from the people. He was chosen only when the state was in imminent danger from foreign enemies or inward seditions. In the time of a pestilence a dictator was sometimes elected, as also in order to hold the *comitia*, or to celebrate the public festivals, or drive a nail into the capitol, by which superstitious ceremony the Romans believed that a plague could be averted or the progress of an enemy stopped. But this office, so

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Dictionary. respectable and illustrious in the first ages of the republic, became excessively odious by the usurpations of Sylla and Julius Cæsar; and after the death of the latter, the Roman senate passed a decree abolishing for ever the dictatorship in Rome. The dictator, as soon as elected, chose a subordinate officer, who was called his master of horse, *magister equitum*. This officer was respectable; but he was totally subservient to the will of the dictator, and could do nothing without the express order of the latter. This subordination, however, was some time afterwards removed; and during the second Punic war the master of the horse was invested with a power equal to that of the dictator. A second dictator was also chosen for the election of magistrates at Rome after the battle of Cannæ. The dictatorship was originally confined to the patricians; but the plebeians were afterwards admitted to share it. Titus Lartius Flavius was the first dictator, in the year of Rome 253.

DICTIONARY, in its original acceptation, is the arranging of all the words of a language according to the order of the alphabet, and annexing a definition or explanation to each word. When arts and sciences began to be improved and extended, the multiplicity of technical terms rendered it necessary to compile dictionaries, either of science in general, or of particular sciences, according to the views of the compiler.

DICTIONARY of the English Language. The design of every dictionary of language is to explain, in the most accurate manner, the meaning of every word; and to show the various ways in which it can be combined with others, in as far as this tends to alter or modify its meaning. The dictionary which does this in the most accurate manner is the most complete work of the kind; therefore the principal study of a lexicographer ought to be to discover the method which may seem best adapted for that purpose. Dr Johnson, with great labour, has collected the various meanings of every word, and quoted the authorities; but it would have been an improvement if he had given an accurate definition of the precise meaning of every word; pointed out the way in which it ought to be employed with the greatest propriety; showed the various deviations from the original meaning, which custom had so far established as to render allowable; and fixed the precise limits beyond which it could not be employed without becoming a vicious expression. With this view it would have been necessary to exhibit the nice distinctions which take place between words nearly synonymous, and without which many words can only be defined in such a manner that they must be considered as exactly synonymous. We omit making any quotations from Johnson in order to point out these defects; and shall content ourselves with giving a few examples, to show in what manner, according to our idea, a dictionary of the English language ought to be compiled.

IMMEDIATELY, *adv. of time.*

1. Instantly, without delay. Always employed to denote future time, and never past. Thus we may say, *I will come immediately*; but not *I am immediately come from such a place*. See **PRESENTLY**.

2. Without the intervention of any cause or event; as opposed to *mediately*.

PRESENTLY, *adv. of time.*

1. Instantly, without delay. Exactly synonymous with *immediately*; being never with propriety employed to denote any thing but future time.

2. Formerly it was employed to express present time. Thus, *The house presently possessed by such a one*, was often used, but this has now become a vicious expression; and we ought to say, *The house possessed at present*. It differs from *immediately* in this, that

even in the most corrupt phrases it never can denote past time.

FORM, *subst.* The external appearance of any object, when considered only with reference to shape or figure. This term, therefore, in the literal sense, can only be applied to the objects of sight and touch, and is therefore nearly synonymous with *figure*; but these terms differ in some respects. *Form* may be employed to denote more rude and unfinished shapes; *figure*, those which are more perfect and regular. *Form* can never be employed without denoting matter, whereas *figure* may be employed in the abstract: thus we say a square or a triangular *figure*, but not a square or triangular *form*. And in the same manner we say the *figure* of a house; but we must denote the substance which forms that figure if we use the word *form*; as, *a cloud of the form of a house*. See **FIGURE**.

2. In contrast to irregularity or confusion. As beauty cannot exist without order, it is by a figure of speech employed to denote beauty, order, and the like.

3. As *form* respects only the external appearance of bodies, without regard to their internal qualities, it is, by a figure of speech, employed in contrast to these qualities to denote empty show, without essential qualities. In this sense it is often taken when applied to religious ceremonies, pageantry, and so forth.

4. As *form* is employed to denote the external appearance of bodies, so, in a figurative sense, it is applied to reasoning, denoting the particular mode or manner in which this is conducted; as, *the form of a syllogism*, &c.

5. In the same manner it is employed to denote the particular mode of procedure established in courts of law; as, *the forms of law, religion*, and the like.

6. *Form* is sometimes, although improperly, used to denote the different circumstances of the same body; as, *water in a fluid or a solid form*. But as this phrase regards the internal qualities rather than the external figure, it is improper, and ought to be, *water in a fluid or a solid state*.

7. But when bodies of different kinds are compared with one another, this term may be employed to denote other circumstances than shape or figure; for we may say, *a juice exuding from a tree in the form of wax or resin*; although, in this case, the consistence, colour, &c. and not the external arrangement of parts, constitutes the resemblance.

8. From the regular appearance of a number of persons arranged in one long seat, such persons so arranged are sometimes called a *form*; as, *a form of students*, &c. And,

9. By an easy transition the seat itself has also acquired that name.

GREAT, *adj.* A relative word, denoting largeness of quantity, number, &c., serving to augment the value of those terms with which it is combined, and opposed to *small* or *little*. The principal circumstances in which this word can be employed are the following:

1. When merely inanimate objects are considered with regard to quantity, *great* is with propriety employed to denote that the quantity is considerable: as, *a great mountain, great house*, and the like; and it is here contrasted with *small*. When *great* is thus employed, we have no other word which is exactly synonymous.

2. When inanimate objects are considered with regard to their extent, this term is sometimes employed, although with less propriety; as, *a great plain, a great*

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field, and the like. In this sense it is nearly synonymous with *large*; and these terms were often used indiscriminately, but with some difference of meaning; for, as *large* is a term chiefly employed to denote extent of superficies, and as *great* more particularly regards the quantity of matter, therefore, when *large* is applied to any object which is not merely superficial, it denotes that it is the extent of surface which is there meant to be considered, without regard to the other dimensions; whereas, when the term *great* is employed, it has reference to the whole contents. If, therefore, we say *a large house*, or *a large river*, we express that the house, or the river, has a surface of great extent, without having any necessary connexion with the size in other respects. But if we say *a great house*, or *a great river*, it at once denotes that these objects have not only a large surface, but are also of great size in every respect.

3. *Great*, when applied to the human species, never denotes the size or largeness of body, but is applied solely to the qualities of the mind. Thus when we say that *Socrates was a great man*, we do not mean that he was a man of great size, but that he was a man who excelled in the endowments of the mind. The terms which denote largeness of size in the human body are *big*, *bulky*, *huge*.

4. *Great* is sometimes applied to the human species, as denoting high rank. In this case it is oftener used in the plural number than otherwise. Thus we say simply *the great*, meaning the whole body of men in high station, as opposed to the *mean*. It should seldom be employed in this sense, as it tends to confound dignity of rank with elevation of mind.

5. As this is a general term of augmentation, it may be joined with all nouns which denote *quantity*, *quality*, *number*, *excellence*, or *defects*; or such as imply *praise*, *blame*, *anger*, *contempt*, or any other affection of the mind.

6. It is employed to denote every step of ascending or descending consanguinity, as *great-grandfather*, *great-grandson*, and so on.

HIGH, adj. Exalted in a perpendicular direction at a distance from the surface of the earth, and opposed to *low*.

1. *High* is a term altogether indefinite, and is employed to express the degree of elevation of any inanimate body. Thus we say *a high mountain*, *a high house*, *steeple*, *tower*, *pillar*, and the like. Nor is there any other word which can here be considered as synonymous; *lofty* being employed only to denote a very eminent degree of elevation.

2. To express the perpendicular elevation of vegetables either *high* or *tall* may be employed, as being in this case nearly synonymous. We may therefore say *a high or tall tree*, *a high or tall mast*, and so forth, but with this difference between these two expressions, that *tall* can be more properly applied to those which are much elevated and of small dimensions; and *high*, to such as are more bulky and of greater size.

3. The perpendicular height of man can never be expressed by the word *high*, *tall* being here the proper expression. And although *high* is sometimes used to express the height of other animals, yet it seems to be an improper expression. See **TALL**.

4. *High*, when applied to the human species, always refers to the mind, and denotes *haughtiness*, *stateliness*, *pride*, and when combined with expressions indicating energy of mind, it denotes that in a higher degree. In this sense it is opposed to *meanness*, *abjectness*, and *humility*.

5. As this is an indefinite term, tending to denote any thing which is elevated above us, it may be combined with almost every noun which admits of this elevation. Hence, as objects high above us are always out of our reach, it is in a metaphorical sense used to denote any thing which seems to be above the ordinary condition of mankind, or those qualities or endowments of mind which are not easily acquired; as, *dignity* or *elevation of sentiment*, *dignity of rank*, *acuteness in reasoning on difficult subjects*, *pride*, *haughtiness*, or any other quality which seems beyond the ordinary level of mankind; *dearness of price*.

6. In the same manner we apply this term to time, which having a metaphorical resemblance to a river flowing on with an unceasing current through all successive ages, any thing of remote antiquity is denoted by the term *high*.

7. Likewise to those degrees of latitude far removed from the line, where the pole becomes more elevated.

8. And also to some particular crimes, as being attended with peculiar degrees of guilt, as *high treason*.

TALL, adj. Something elevated to a considerable degree in a perpendicular direction, and opposed to *low*.

1. This term is chiefly employed to express the height of man and other animals; and is applied to denote the height of the body only, without having any reference to the mind. When applied to man, no other word can be substituted in its stead; when applied to other animals, *high* is sometimes considered as nearly synonymous. See **HIGH**.

2. It is likewise employed to denote the perpendicular height of vegetables, and in this case it is nearly synonymous with *high*. See **HIGH**.

3. It can in no case be employed to express the height of merely inanimate objects, as we can never say *a tall steeple*, *tower*, or *pillar*, but *a high steeple*, &c. For the distinctions in these cases, see **HIGH**.

LONG, adj. A relative term, denoting the distance between the extremes of any body which is extended more in one of its geometrical dimensions than in another. It is opposed to *short*.

1. This term may be applied to all inanimate objects, of whatever kind, whose dimensions in one way exceed their dimensions in the other, and when not in an erect posture, whatever be the other circumstances attending them, whether it relates to superficies alone or to solid bodies, whether these be bounded or open, straight or crooked, flexible or rigid, or in any other circumstances whatever; thus we say *a long or short line*, *a long or short ridge*, *street*, *ditch*, *rope*, *chain*, *staff*, and the like. But it is to be observed, that although *long* is in the strict sense only opposed to *short*, yet as it expresses the extension of matter in one of its geometrical proportions, it is often contrasted by those words which express the other proportions when we mean only to describe the several proportions; as, *a table long and broad*. And as these several dimensions are expressed by different words, according to the various forms, modifications, and circumstances in which bodies are found, therefore it is in this sense contrasted by a great diversity of terms; as, *a long and broad or wide*, *narrow or strait*, *street or lane*; *a long and thick or small rope*, *chain*, *staff*. For the distinctions in these cases see **BROAD**, **WIDE**, &c.

2. Objects necessarily fixed in an erect position can never have this term applied to them, and therefore we cannot say *a long*, but *a high tower* or *steeple*. And for the same reason, while trees are growing and fixed in an erect position, we cannot apply this term to them; but when they are felled and laid upon the

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ground, it is quite proper and necessary. Thus we do not say a *long*, but a *tall* or *high* tree, while it is growing; but we say a *long*, not a *tall* log of wood; and in the same manner we say a *tall* mast when it is fixed in the ship, but a *long* mast while it lies upon the beach. See TALL and HIGH.

3. Those vegetables which are of a tender, pliant nature, or so weak as not to be able to retain a fixed position, being considered as of a middle nature between erect and prostrate bodies, admit of either the terms *long*, *tall*, or *high*; as, a *long* or *tall* rush or willow wand, or a *long*, *tall*, or *high* stalk of corn. See HIGH and TALL.

4. The parts of vegetables, when considered as distinct from the whole, even when growing and erect, assume the term *long*; for we do not say a *tall*, but a *long* shoot of a tree, and a tree with a *long* stem, in preference to a tree with a *high* stem.

5. For the same reason, a staff and pole, even when fixed in a perpendicular direction, assume the word *long*, in preference to *tall* or *high*.

6. With regard to animals, the general rule is applied, without any exceptions; *tall*, and not *long*, being employed to denote the height of the human body when in an erect posture; and *long*, and not *tall*, to denote its length when in an incumbent situation. *Long* applied to all other animals which do not walk erect, always denotes their greatest length in a horizontal position from head to tail.

7. In a figurative sense, it denotes, with regard to time, any thing at a great distance from us.

8. As also, any thing that takes up much time before it is finished, as, a *long* discourse, a *protracted* note in music, and the like.

BROAD, adj. The distance between the two nearest sides of any body whose geometrical dimensions are larger in one direction than in another. It has a reference to superficies only, and never to the solid contents, and is opposed to *narrow*.

1. *Broad*, in the strictest acceptation, is applied to denote those bodies only whose sides are altogether open and unconfined; as, a *broad* table, a *broad* wheel, &c. and in these cases it is invariably contrasted with *narrow*; nor is there any other word which in these cases can be considered as synonymous with it, or be used in its stead.

2. When any object is in some sort bounded on the sides, although not quite closed up, as a road, street, ditch, and the like, either *broad* or *wide* may be employed, but with some difference of signification; *broad* being most properly used for those which are more open, and *wide* for those which are more confined: nor can this term be ever applied to such objects as are closely bounded all around, as a house, a church, and the like, *wide* being here employed. For the more accurate distinctions in these cases see the article WIDE.

WIDE, adj. A term employed to denote relative extent in certain circumstances, and opposed to *narrow* and *strait*.

1. This term is in its proper sense applied only to denote the space contained within any body closed all round and on every side; as, a house, gate, or the like; and it differs from *broad* in this, that it never relates to the superficies of solid objects, but is employed to express the capaciousness of any body which contains vacant space; nor can capaciousness in this sense be expressed by any other word but *wide*.

2. As many bodies may be considered either with respect to their capaciousness or superficial extent, in all these cases either the term *broad* or *wide* may be used;

as, a *broad* or *wide* street or ditch, &c.; but with a greater or less degree of propriety, according to the circumstances of the object, or the idea which we wish to convey. In a street where the houses are low and the boundaries open, or in a ditch of small depth and large superficies, as this largeness of superficies bears the principal proportion, *broad* would be more proper; but if the houses are of great height, or the ditch of great depth, and capaciousness is the principal property which affects the mind, we would naturally say a *wide* street or ditch; and the same may be said of all similar cases. But there are some cases in which both these terms are applied, with a greater difference of meaning; thus we say a *broad* or a *wide* gate. As the gate, however, is employed to denote either the aperture in the wall, or the matter which closes that aperture, these terms are each of them used to denote that particular quality to which they are generally applied; and as the opening itself can never be considered as a superficies, the term *wide*, in this case, denotes the distance between the sides of the aperture; whilst, on the contrary, *broad* denotes the extent of matter fitted to close that aperture; nor can these two terms be in any case substituted for one another.

3. As a figurative expression, it is used as a cant phrase for a mistake; as, *you are wide of the mark*; that is, not near the truth.

NARROW, adj. A relative term, denoting a proportional smallness of distance between the sides of the superficies of plain bodies, and opposed to *broad*.

1. As this is only applied to superficies, it is exactly contrasted by *broad*, and is applied in all cases where the term *broad* can be used (see BROAD); and in no other case but as a contrast to it, excepting the following.

2. It sometimes is employed to describe the smallness of space circumscribed between certain boundaries, as opposed to *wide*, and nearly synonymous with *strait*; thus we say a *wide* or a *narrow* house, church, and the like. For the necessary distinctions here, see the article STRAIT.

3. In a figurative sense it denotes *parsimony*, *poverty*, *confined sentiments*, and so forth.

STRAIT, adj. A relative term, denoting the extent of space in certain circumstances, and opposed to *wide*. See WIDE.

1. This term is employed, in its proper sense, to denote only space, as contained between surrounding bodies in such circumstances as to denote some degree of confinement, and is exactly opposed to *wide*; as, a *wide* or a *strait* gate, &c. See WIDE.

2. So necessary is it that the idea of confinement should be connected with this word, that in all those cases where the space contained is large, as in a church or house, we cannot express a smaller proportional width by this term. And as we have no other word to express space in these circumstances, we are obliged to force the word *narrow* from its natural signification, and make it express this. See NARROW.

3. In some particular cases, *narrow* or *strait* may be applied to the same object; as, a *narrow* or a *strait* line; but here *strait* is never employed except where an idea of confinement is suggested, and where it is exactly contrasted to *wide*; nor can *narrow* be employed except in such circumstances where *broad* would be a perfect contrast to it. Therefore these two terms may be always used in the same circumstances as those which contrast with them. For an account of these see WIDE.

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4. The term *strait* is likewise in a peculiar manner used to denote the smallness of the internal diameter of those bodies which are fitted to receive or contain others, as any kind of bag, tube, body clothes, mortises, and others of the same kind; and in all these cases this term may be employed to denote the smallness of their lesser diameter, and never the term *narrow*. But in certain circumstances the word *tight* may be substituted for it. See TIGHT.

5. *Strait*, in a figurative sense, denotes any sort of confinement of sentiment or disposition.

TIGHT, *adj.* A term employed in certain circumstances to denote the internal capacity of particular bodies, and nearly synonymous with *strait*.

This term is confined entirely to denote the smallness of the internal dimensions of such objects as are formed to cover, or to receive or contain, other solid bodies, and can be employed in no other case. And although it agrees with *strait*, in always denoting confinement, and by being applicable to the same species of objects, yet it differs in the following respects: 1. If there be any difference of the diameter of the objects to which the term *strait* can be applied, it has always reference to the smaller; yet *tight* may be applied to any sort of confinement, whether it regards the length or breadth. 2. *Strait* can be applied to all bodies of capacity when of small diameter, without any sort of reference to the nature of the substance which it may be capable of containing. For we can say *a strait bag, a strait sleeve, a strait mortise, a strait gate*, and so on, whereas *tight* can only be applied to any body when it is considered as having reference to another body which is intended to be contained in it, and is pinched from want of room. Thus we say *the sleeve of a coat is too tight for the arm, the mortise is too tight for the tenon*, and so forth; but we cannot say *the bag or the gate is too tight*, because they are fitted to receive any sort of objects. And hence it happens that in many cases the dimensions of the same body may be expressed by *tight* or *strait*, when considered in different circumstances. Thus we may say, *this sleeve is too strait*, when we look at a coat lying on the table and consider its proportions; but it is not till we have tried it upon the arm which it is intended to cover, that we call it *tight*. And we may say, *a gate is too strait or too tight*; but in the first case we consider it as being too confined for admitting objects to pass through it; and in the next, as being too confined with respect to the "leaves" which are to shut the aperture not allowing them space to move with freedom.

These examples may serve to give some idea of the plan of an English dictionary composed upon philosophical principles. But, besides the circumstances above enumerated, there are many others which would require particular attention in the execution of a work of this kind. In the English language a great variety of terms occur which denote matter under certain general forms or circumstances, without regarding the minute diversities that may take place; as the word *cloth*, which denotes matter as manufactured into a particular form, including under it all the variety of stuffs manufactured in that particular way, of whatever materials, colour, texture, or fineness they may be. The same may be said of *wood, iron, yarn*, and a great variety of terms of the same nature, some of which cannot assume any plural; whilst others admit of it in all cases, and others, again, admit or refuse it according to the different circumstances in which they are considered.

In a dictionary, therefore, all this variety of cases ought

to be clearly and distinctly pointed out under each particular article. This is the more necessary, as some of these words have others formed from them which might be readily mistaken for their plurals, although they have a very different signification; as *clothes*, which does not denote any number of pieces of different kinds of *cloth*, but *wearing apparel*. The following example will illustrate this head.

WOOD, *subst.* A solid substance of which the trunks and branches of trees consist.

1. This term is employed to denote the solid parts of vegetables of all kinds, in whatever form or circumstances they are found. Nor does it admit of a plural with propriety, unless in the circumstances after mentioned; for we say, *many different kinds of wood*, in preference to *many kinds of woods*; or we say, *oak, ash, or elm wood*, not *woods*.

2. But where we want to contrast wood of one quality or country with that of another, it admits of a plural; for we say, *white woods are in general softer than red*; or, *West Indian woods are in general of greater specific gravity than the European woods*. But unless where the colour, or some quality which distinguishes it from growing wood, is mentioned, this plural ought as much as possible to be avoided, as it always suggests an idea of growing wood.

3. *Wood* likewise denotes a number of trees growing near one another, being nearly synonymous with *forest*. See FOREST. In this sense it always admits of a plural; as, *Ye woods and wilds whose melancholy gloom, &c.*

A dictionary cannot be reckoned complete without explaining obsolete words; and if the terms of the several provincial dialects were likewise given, it would be of great utility. Nor would this occupy much space, because a number of these words need no other explanation than to mark along with them the words which had come in their place, when there happened to be one perfectly synonymous; and in those cases where the same idea could not be expressed in modern language without a periphrasis, it would be of use to explain them distinctly; so that, when a writer found himself at a loss for a term, and was obliged to search for one beyond the bounds of his own language, he might take one of these, if he found it expressive and energetic, in preference to another drawn from a foreign language. This would at least have one good effect; it would render our language more fixed and stable, not to say more accurate and precise, than by borrowing from foreign languages. The following examples may serve to give some idea of the manner of treating this part of the work.

MOE, or MO, *adj.* An obsolete term still employed in the Scotch dialect, and by them pronounced *mae*, denoting a greater number, and nearly synonymous with *more*; but it differs in this respect, that in the Scotch dialect, *mae* and *mair* (English *more*) are each employed in their distinct sphere, without encroaching upon one another, *mae* being employed to denote number, but never quantity or quality, and *mair* to denote quantity and quality, but never number; thus they say *mae, not mair, apples, men, &c.* and *mair, not mae, cloth, earth, courage, &c.* See MAIR. Both these terms are supplied by the word *more*, which in the English language is applied indiscriminately to denote quantity, quality, and number. See MORE.

As the English language is so exceedingly irregular in the pronunciation, the same letter in the same situation often assuming sounds totally different in different words, it is impossible to establish any general rules on this subject which do not admit of many exceptions; therefore a

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Dictymnia dictionary is the best means of ascertaining and pointing out the proper pronunciations of words. For, if the writer first pointed out all the different sounds which the same letter could ever be made to express, and assigned to every particular sound which each letter could be made to assume, a particular mark, appropriated to denote that particular sound of the letter whenever it occurred, by placing these particular marks above the letters in the dictionary, the sound of each letter would be pointed out in all cases with the utmost certainty. It is impossible to illustrate this by examples, without first ascertaining all the sounds of each letter, which would lead into a discussion too long for this place.

We shall only further observe, that besides having the accented syllable of every word *properly* distinguished in a dictionary to assist in the pronunciation, the English language requires another essential improvement, namely, the use of accents to distinguish the meaning of *words* and *phrases*, which, although it is not so properly confined to a lexicographer, yet it is not quite without his sphere. Thus, the word *as* admits of two very different sounds, as well as different significations; for example, "Cicero was nearly *as* eloquent *as* Demosthenes;" in which the first *as* is pronounced *ass*, and the last is pronounced *az*. Now it often happens that, in reading, the particular way in which it ought to be understood is not pointed out by the context till after the word itself is pronounced, which has an equal chance at least of being pronounced wrong; whereas, if it were always accented when employed in the one sense, and not in the other, it would free the reader from this perplexity. There are other cases in which the proper use of accents in writing would be of great consequence; as at the beginning of a sentence when it is put as a question, or used ironically. But this does not so properly belong to the lexicographer as the grammarian.

The above examples, we hope, will be sufficient to give the reader some idea of the plan which we would propose, and will enable him to determine whether or not a dictionary, executed in this way, would convey to his mind a more perfect knowledge of the English language than those dictionaries which have hitherto been published. These examples are given rather with a view to show the manner in which a work of this kind may be conducted, than as perfect and unexceptionable explanations of the several articles there enumerated; and therefore we have not thought it necessary to produce any authorities, although we are sensible that they would be requisite in such a work.

DICTYMNIA, or **DICTINNIA**, in *Mythology*, were feasts celebrated at Lacedæmon and in Crete, in honour of Diana Dictymnia or Dictynnia, or of a nymph taken for her, who, having plunged herself into the sea to escape the passion of Minos, was caught in a fisherman's net or δίπτυον, and hence the name.

DICTYS CRETENSIS, a very ancient historian, who served under Idomeneus, king of Crete, in the Trojan war, and wrote the history of that expedition in nine books. Tzetzes tells us that Homer formed his Iliad upon the plan of that history. It is, however, maintained that the Latin history of Dictys now extant is spurious.

DIDACTIC, in the schools, signifies the manner of speaking or writing adapted to teach or explain the nature of things. The word is formed from the Greek διδάσκω, *doceo*, I teach.

There are many words which are only used in the didactic and dogmatic way; and there are also many works, ancient and modern, both in prose and verse, written after this method. Such are the Georgics of Virgil, Lucretius's poem *De Rerum Natura*, and Pope's Essays on Criticism and on Man.

DIDEROT, DENIS, a French writer and philosopher, Diderot. was the son of a cutler, and born at Langrès in the year 1712. He received his education among the Jesuits, and being destined for the church by one of his uncles, who had a canonry to bestow upon him, he assumed the tonsure. But he discovered so little inclination for the ecclesiastical profession, that his father sent him to Paris to prosecute his studies, and afterwards placed him with an attorney. It soon appeared, however, that he was more attached to different departments of literature and science than disposed to submit to the drudgeries of the profession to which his father had destined him; and having neglected his business, his allowance was withheld, which obliged him to shift for himself, and to give lessons in order to procure a subsistence. The studies to which Diderot devoted his attention were extremely various. Physics, geometry, metaphysics, moral philosophy, and belles-lettres, were at different times the objects of his pursuit; and he even indulged in poetry and works of invention. But he attached himself chiefly to graver and more serious studies. Diderot possessed great fluency and animation of language in conversation; and this accomplishment, with a decisive tone and manner, procured him both partizans and protectors.

One of the first of his publications was a translation of Stanyan's *History of Greece*. In the year 1745 he published *Principles of Moral Philosophy*, 12mo, a work by which he obtained some reputation. But the year following, when he published a piece entitled *Pensées Philosophiques*, he acquired considerable celebrity. This work was highly commended by the partizans of the new philosophy, amongst whom he had now enlisted himself. The same work was afterwards reprinted under the title of *Etrennes aux Esprits Forts*: it was very much read, and is supposed to have contributed greatly to the diffusion of those free opinions which had now become so prevalent in France. Soon after this period, Diderot, in conjunction with D'Alembert, concerted the plan of that vast undertaking, the *Dictionnaire Encyclopédique*. The professed object of this work was to form a magazine of every branch of human knowledge; but it has been alleged that it was also intended by the authors and editors as the great engine by means of which established opinions, whether of a religious or political nature, which they supposed had their origin in fraud and superstition, were to be subverted. The department of this work which was entrusted to Diderot was the description of arts and trades (*arts et métiers*). In fact, he was the principal architect of this great edifice; and, besides the Prospectus, and the *Système des Connaissances Humaines*, which has been much commended on account of its classification, he contributed many articles in various departments of science. But his writings in the Dictionary have been considered as extremely verbose and diffuse; and in all of them he is too fond of metaphysical subtilties and the pompous parade of scientific language. The first two volumes of the Dictionary appeared in the year 1751, and the first edition was completed and published in 1767; but although Diderot was occupied in this laborious undertaking for a period of nearly twenty years, the recompense which he obtained for his labours is said to have been extremely small.

During this time he composed various other works. Amongst these may be mentioned *A Letter on the Blind*, for the use of those who see. This work made a good deal of noise, and, in consequence of some of the sentiments it contained, gave offence to the government, for which reason the author was detained in confinement during six months at Vincennes. This piece was soon followed by another, entitled *A Letter on the Deaf and Dumb*, 2 vols. 12mo, 1751. The *Sixth Sense*, which was published in

Diderot. 1752; *Thoughts on the interpretation of Nature*, which appeared in 1754; and *The Code of Nature*, in 1755; are similar works, and may be ranked in the same class. His moral character was considerably affected by the publication of *Bijoux Indiscrets*, in two vols. 12mo, which is a collection of licentious tales; but for this he made some kind of compensation when he published two prose comedies, entitled *Le Fils Naturel*, 1757, and *Le Père de Famille*, 1758, which are not only interesting as dramatic pieces, but exhibit a pure and correct morality. The latter is considered as one of the best comedies of the sentimental kind which has appeared on the French stage, and it has accordingly been much admired. He afterwards published a pamphlet on Public Education, which undoubtedly contains some useful hints, but at the same time it proposes many things which are utterly absurd and impracticable. To the list of his works now mentioned we may add an eulogy on Richardson, which is full of warmth and enthusiasm; and an Essay on the Life and Writings of Seneca the Philosopher. This was his last production, and was published in 1779.

The character of Diderot suffered considerably from some defamatory attacks which he had made on his former friend Rousseau, who had quarrelled with the French philosophers, and had separated himself from their school. From the *Confessions* of the philosopher of Geneva, it would appear that they expected of him some anecdotes which would not have redounded much to their honour. In one of his letters Rousseau, speaking of Diderot, says, "Although born with a good heart and an open disposition, he had an unfortunate propensity to misinterpret the words and actions of his friends, and the most ingenuous explanations only supplied his subtle imagination with new interpretations against them."

Diderot was married and had a family; and, although he possessed considerable irritability of temper, he was, it seems, a kind husband and a tender parent. At the conclusion of the Dictionary, the state of his affairs having rendered it necessary for him to dispose of his library, it was purchased by the empress of Russia, who, with the king of Prussia, was at that time the great encourager of literature and literary men. These sovereigns were also considered as disciples of the French school. The price which Diderot received for his library was fifty thousand livres, and he was to have the use of it during his life. But some of his biographers, with what truth we know not, have not hesitated to charge him with disposing of it a second time; they state, that when some person commissioned by the empress wished to see it, the philosopher declined the visit on various pretences, until he had had time to fill it with books borrowed from booksellers. The examination, it is obvious, must have been extremely superficial, otherwise the truth would have been at once detected. Diderot had been admitted a member of the Academy of Sciences at Berlin; but the doors of the French Academy remained closed against him to the last. He died suddenly, as he rose from table, on the 31st July 1784. His literary and philosophical works were collected and published by his friend Naigeon, in 15 vols. 8vo, at Paris, in 1798. This collection has been enlarged, in subsequent republications, to 22 vols. 8vo, Paris, 1821; and it contains a Memoir of Diderot.

Diderot, it would seem, had a hand in several of the most remarkable works of his time, published under the names of others. "Who does not know," says Grimm, in his *Correspondance*, "that nearly a third of the *Histoire Philosophique* of Raynal belongs to him? He laboured on it during two years, and a considerable part of it was even composed under my own eyes. Diderot himself was often startled at the boldness with which he had made his friend

the abbé speak. 'Who,' asked he, 'who will venture to subscribe this?' 'I,' replied the abbé, 'I will subscribe it; proceed, I tell you.' What man of letters is there who may not easily recognise in the book *De l'Esprit* (of Helvetius), and in the *Système de la Nature*, all the fine passages which are, and could only be, from the pen of Diderot? If we undertook to make a more complete enumeration, we should run the risk of naming many ungrateful individuals." (*Correspondance Littéraire, Philosophique, et Critique*, tom. iv. p. 85.) Grimm further states that Diderot furnished a great number of pages to the *Système de la Nature*, and that he likewise laboured, though to less extent, on the *Système Social* and the *Morale Universelle*, also published by Baron d'Holbach. Such were some of the indirect literary efforts of Diderot. But neither as a writer nor as a philosopher did he make for himself any very enviable reputation. As a writer he was decidedly a bad model; he had neither plan nor connection, and knew not how *proprie communia dicere*, whilst his style was deformed by obscurity, neologisms, and a tone of insufferable dogmatism; but nevertheless he was often vigorous, sometimes eloquent, and hit off happy traits of expression, as well as striking truths, which, however, would have gained much by being more simply enunciated. In fact, he had frequently the air of being *in cathedra*; he aimed at ambitious formularies, and fatigued by his strained style, by his prodigal sallies, and by an enthusiasm which seldom appeared natural. As a philosopher he wrote under the influence of a heated imagination rather than under that of cool reason. He was almost always exalted and extravagant; seldom or never simple and natural. His friends, however, have celebrated his goodness, his frankness, his easy and obliging character, and the vigour and *entrainement* of his conversation. Grimm, who has praised him warmly in his *Correspondance*, regards Diderot as having had the most naturally encyclopædical head of any man that ever lived. He admires his energy, his warmth, the variety of his ideas, the multiplicity of his acquirements, the impetuous tumult of his imagination, and the charm and irregularity of his conversation. Then he adds, "However willingly I may pardon all men for believing nothing, I think that it would have been very desirable for the reputation of Diderot, perhaps even for the honour of his age, if he had not been an atheist. The determined war which he thought himself obliged to carry on against God, caused him to lose the most precious moments of his life." (*Correspondance*, 3me partie, tom. iv. p. 87.) But Naigeon, who is less considerate than Grimm, praises his friend without qualification, adding, besides, that "his age has not done him justice." It is possible indeed that some persons may have too much depreciated the merit of Diderot; but others again exalted it beyond all measure. The general opinion in regard to him, however, seems now to be pretty well fixed, and posterity has at length put him in his right place. He had talent; he was capable of warmth and elevation; but he wanted sagacity, moderation, and taste. "He has written fine pages," says Marmontel in his *Mémoires*, "but he never knew how to make a book." He adopted a desolating and destructive system, and he dishonoured his cause by the exaggeration of most of his principles, and by the license which reigns in many of his productions. This explains the reason why he never entered the academy, whose doors, as we have already stated, were constantly shut against him, notwithstanding the anxious desire of his friends to procure him admission. Voltaire, who had himself solicited his election, appears latterly to have become less enamoured of the merit of Diderot, and even to have formally censured some of his works. D'Alembert also cooled towards him, and at last they did not even see each other. His rupture with

Diderot.

Didier
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Dido.

Rousseau, however, was the work of the latter, who began the war which was afterwards waged between them. But Diderot maintained his connection with Baron d'Holbach, whose sentiments approached the nearest to his own on several important points; and in the society of the baron he was relished and admired by reason of his facility in speaking on subjects of all sorts, and no doubt also by his antipathy to that creed, and to those institutions, which were no longer revered or respected. On this topic he never tired, and his friends often amused themselves with affording him opportunities to abandon himself to his imagination, or, in other words, to blaspheme for their diversion. In an unexcited state he exhibited constraint, awkwardness, timidity, and even a kind of affectation. He was never truly Diderot except when his fancy had transported him as it were beyond himself. Enthusiasm had become the condition of being most natural to his mind, nay, even to his voice and features; and he was himself only when in a state of intellectual inebriety. Grimm has reproached him with having consumed in fugitive conversations the time which he might have devoted to more durable labours; but Diderot loved to talk, especially when he could indulge his vehement volubility without interruption; for, as Voltaire once remarked on leaving a company where Diderot had engrossed the whole talk, "*Cet homme-là n'est pas propre pour le dialogue.*" The correspondence recently published has thrown but little new light on the character of this remarkable man, nor has it tended in any material degree to increase the estimation in which his talents and dispositions were previously held by the world.

DIDIÈR, St, a city of the department of the Upper Loire, in France, with 3203 inhabitants, who are employed chiefly in the silk manufacture.

DIDO, called also ELISA, a daughter of Belus, king of Tyre, who married Sichæus or Sicharbas, her uncle, who was priest of Hercules. Pygmalion, who succeeded to the throne of Tyre after Belus, murdered Sichæus in order to obtain possession of the immense riches which he had acquired; and Dido, disconsolate for the loss of her husband, whom she tenderly loved, and by whom she was equally esteemed, set sail in quest of a settlement with a number of Tyrians, to whom the cruelty of the tyrant had become odious. According to some accounts, she threw into the sea the riches of her husband which Pygmalion so greedily desired; and by this artifice compelled the ships which had come by order of the tyrant to obtain the riches of Sichæus to join in her flight. During her voyage Dido visited the coast of Cyprus, where she carried away fifty women who had prostituted themselves on the seashore, and gave them as wives to her Tyrian followers. A storm drove her fleet on the African coast, and she bought of the inhabitants as much land as could be covered by a bull's hide cut into thongs. Upon this piece of ground she built a citadel called *Byrsa*; and the increase of population, and the rising commerce among her subjects, soon obliged her to enlarge her city and extend the boundaries of her dominions. Her beauty, as well as the fame of her enterprise, gained her many admirers; and her subjects wished to compel her to marry Iarbas, king of Mauritania, who threatened them with a dreadful war. Dido begged three months to give her decisive answer; and during that time she erected a funeral pile, as if wishing by a solemn sacrifice to appease the manes of Sichæus, to whom she had promised eternal fidelity. When all was prepared, she stabbed herself on the pile in presence of her people; and by this uncommon action obtained the name of *Dido*, or valiant woman, instead of Elisa. According to Virgil and Ovid, the death of Dido was caused by the sudden departure of Æneas,

of whom she had become deeply enamoured, and whom she could not obtain as a husband. This poetical fiction represents Æneas as living in the age of Dido, and introduces an anachronism of nearly 300 years. Dido left Phœnicia 247 years after the Trojan war, or the age of Æneas; that is, about 953 years before Christ. This chronological error proceeds not from the ignorance of the poets, but it is supported by the authority of Horace.

Aut famam sequere, aut sibi convenientia finge.

Whilst Virgil, in a beautiful episode, describes the desperate love of Dido, and the submission of Æneas to the will of the gods, he at the same time gives an explanation of the hatred which existed between the republics of Rome and Carthage; and informs his reader that their mutual enmity originated from their very foundation, and was apparently kindled by a more remote cause than the jealousy and rivalry of two flourishing empires. Dido after her death was honoured as a deity by her subjects.

DIDYMUS of Alexandria, an ecclesiastical writer of the fourth century, who, though he is said to have lost his eyes at five years of age, when he had scarcely learned to read, yet applied so earnestly to study, that he attained all the philosophic arts in a high degree, and was thought worthy to fill the chair in the famous divinity school at Alexandria. He was the author of a great number of works; but all which we have now remaining are, a Latin translation of his book upon the Holy Spirit, in the works of St Jerome, who was the translator; short strictures on the Canonical Epistles; and a book against the Manicheans.

DIE, an arrondissement in the department of the Drome, in France, 946 square miles in extent. It is divided into nine cantons and 117 communes, and contains 60,518 inhabitants. The capital, a city of the same name, is situated on the right bank of the Drome. It has some silk mills and cloth manufactures, and contains 3421 inhabitants. Near to it is one of the wonders of Dauphiné, the inaccessible mountain, whose base and summit are of the same extent. Long. 5. 13. E. Lat. 44. 44. N.

DIEBURG, a city in the grand duchy of Hesse Darmstadt, once a small sovereignty of the Counts Lerchenfelds, but now mediatised. It contains 408 houses, and 2216 inhabitants.

DIEKIRCH, a city, the capital of the department of the same name, in the duchy of Luxemburg. The department is divided into six cantons, and contains a population of 47,074 persons. The city is situated on the river Eure, and contains 2627 inhabitants, who live by preparing gypsum, and by tanning leather.

DIEMEN'S LAND. See AUSTRALASIA.

DIEMERBROEK, ISBRAND, a learned professor of physic and anatomy at Utrecht, was born at Montfort, in Holland, in 1609, where he acquired great reputation by his lectures and his practice, and died at Utrecht in the year 1674. He wrote a treatise on the plague, and several works on anatomy and medicine, which were printed at Utrecht in 1685, folio.

DIEPENDEEK, a town in the province of Limburg, in the Netherlands, on the river Demer, with 2136 inhabitants.

DIEPHOLZ, a county, forming with Hoya one of the provinces of the kingdom of Hanover. It extends over 266 square miles, or 170,240 acres, and contains 14,200 inhabitants. One part of it, called Auburg, was transferred in 1815 from Hesse Cassel. The only industry except agriculture is applied to the spinning and weaving of flax. The chief place of the same name is situated on the river Hunte, and contains 353 houses, with 2068 inhabitants.

DIEPPE, an arrondissement of the department of the Lower Seine, in France. It is 490 square miles in extent,

Didymus
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Dieppe.

Dierdorf and contains eight cantons, divided into 222 communes, with a population of 104,207 persons. The chief place is the city of the same name on the Seine, at the mouth of the river Arques. It is fortified on the sea and land sides, and is in the shape of an irregular triangle, whose longest side is towards the sea. It contains 3000 houses, and about 20,000 inhabitants, chiefly dependent on the commerce of the port. Being the best inlet for Paris, it is the great depôt for colonial goods, and the resort of foreign ships, especially of those from America. There are many manufactures, but principally of the kind connected with the equipment of ships; and, besides these, some sugar and salt refineries. From this port William the Conqueror sailed with his forces for England. Long. 0. 59. 7. E. Lat. 49. 55. 17. N.

DIERDORF, a town in the Prussian province of the Lower Rhine, formerly in the principality of Neuwied, and now belonging to the mediatised prince of that name, whose palace is there. It is situated on the river Holtzbach, and contains 1150 inhabitants.

DIES MARCHIÆ was the day of congress or meeting of the English and Scotch, annually appointed to be held on the marches or borders, in order to adjust all differences between them.

DIESIS, in *Music*, is the division of a tone less than a semitone; or an interval consisting of a less or imperfect semitone. Diesis is the smallest and softest change or inflexion of the voice imaginable; it is called a *faint*, and expressed by a St Andrew's cross or saltier.

DIESPITER, in *Antiquity*, a name given to Jupiter, and signifying *dei pater*, father of the day. St Augustin derives the name from *dies*, day, and *partus*, production or bringing forth, it being Jupiter who brings forth the day; and Servius and Macrobius were of the same opinion; the former adding, that in the language of the Osci they called him *Lucencius*, which means the same as *Diespiter* in Latin.

DIESSENHOFEN, a circle in the canton of Thurgau, in Switzerland, including the town of that name, in which are 1200 inhabitants, and a few villages.

DIETETICS.

THE necessity of aliment is explained by a knowledge of the functions of the body, and its selection depends upon the same principles. The living machine, as well as those that are inanimate, wastes in proportion as it is used, and this waste must be supplied. To learn the kind of supply required, the kind of waste and its mode must be ascertained.

General view of the subject. The human body is of a very compound nature; indeed it is the most compound of all bodies, as well as the most complicated of all machines. It is composed of solids and fluids, and these again consist of various chemical elements in different states of combination. A great part of the mass of our bodies consists of water, and certain animal substances, to which chemists have given the name of fibrin, albumen, gelatin, mucus, and osmazone. Our bones consist principally of phosphate of lime. Besides these, some other principles enter into the composition of our bodies, though in comparatively small proportion. All the elementary matters of which these principles consist are continually discharged by the various excretions, but generally in states of combination different from those in which they existed as a part of our body. By the lungs a great deal of carbon and hydrogen is exhaled in the form of carbonic acid gas and vapour; by the skin carbon and hydrogen are also thrown off in considerable quantity; by urine, in addition to carbon, hydrogen, and oxygen, much azote, phosphorus, and lime, are discharged in the form of urea and the phosphate of lime; and by the alvine evacuation, not only the indigestible parts of our aliment are expelled, but also carbon, hydrogen, and azote, which formed integrant parts of our bodies, and have fulfilled their functions in the form of bile, mucus, and intestinal flatus. We therefore see that there is a constant waste of carbon, azote, hydrogen, oxygen, phosphorus, and lime, going on, which must be replaced. But there are only two sources from which this waste can be repaired, the atmosphere in which we live, and the aliment which we introduce into our stomach. The atmosphere consists of oxygen and azotic gases, and it is very doubtful whether any part of either be absorbed or converted into a part of our bodies. At least we may assume, that from the air no part of the materials to supply the waste of the body is derived. These must, therefore, be furnished entirely from the matters introduced into the stomach, and those which are calculated to restore any of the deficient elements or principles alone are alimentary. It is not at all

necessary that these elements should be in the same state of combination with the principles whose loss they are to supply. It is sufficient that the elements be there, for it is the very essence of the function of digestion to analyse the alimentary matters, and reunite their elements into other combinations assimilated to our nature. From this view of the subject, it would however seem, that the more nearly the alimentary substances approach to the nature of the substances whose waste they are to supply, the less change upon them is necessary, and their digestion and assimilation will be more easy. Upon these principles, animal substances should be more easily digested than vegetable, and a larger proportion of their elements should be assimilated, while a smaller proportion should be separated to form excrementitious or indigestible compounds. In the same manner, vegetable substances are more digestible, and generate less excrementitious matter, than inorganic substances, which furnish only a small proportion of assimilable matter, and which must be separated from combinations totally foreign to our nature.

Besides alimentary substances properly so called, there is another class of substances which do not contribute much to repair the waste of our bodies, and yet perform an essential part in the function of digestion. These are called condiments, and their use is to stimulate the organs of digestion to greater activity; and, in fact, they are all much more sapid than the proper alimentary substances, which are in themselves generally insipid or mawkish.

From the view we have taken of aliments, it will appear that they are furnished by all the kingdoms of nature; the mineral kingdom supplying chiefly water and lime, while the vegetable, in addition to these in smaller quantity, yields much carbon and hydrogen; and the animal kingdom, in addition to a proportion of all the preceding elements, furnishes almost all the azote which enters into our composition. Although this statement be generally true, there are facts which at first do not seem to accord with it; and there are some grounds for believing that living bodies have either the power of changing the elementary nature of bodies, or of analysing these bodies we at present consider as simple, so that one is apparently changed into another. Thus some animals, in the state of nature, live only upon animal substances, and it is easy to conceive how, by a very simple process, the blood and flesh of their prey should become a part of their proper blood and flesh. Their elements, and even the combina-

Dies
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Dietetics.

tions of them, are alike. But there are other animals whose flesh and blood do not differ materially from those of carnivorous animals, and which live almost entirely upon vegetable substances far removed from animal nature, and containing little if any azote.

This subject has lately engaged the attention of Magendie,¹ the most distinguished Parisian physiologist of the present day; and his views are the most important lately promulgated upon this point, and throw very great light upon the subject of dietetics. To ascertain the sources from which animals derive the azote which enters into their bodies, he performed some experiments, which appear to prove that azote is an indispensable constituent in the food of animals. For the subjects of his experiments he chose dogs, because, like man, they can be supported by vegetable as well as animal food, and he confined them to the use of pure water, and substances totally devoid of azote. Sugar, perfectly pure, was first tried. Of this, and of distilled water, he allowed an unlimited quantity to a small dog, three years old. For the first seven or eight days it seemed to agree very well with this diet. It was lively, active, and eat and drank as usual. In the second week it began to fall off, although its appetite continued very good, and it eat from six to eight ounces of sugar in the course of twenty-four hours. Its alvine excretions were scarce and scanty, while that by urine was abundant. In the third week it became more emaciated, it lost its liveliness, and its appetite began to fail. During this period also its eyes became affected in a singular and very distressing manner. The emaciation increased every day, its strength failed, and although it continued to eat from three or four ounces of sugar daily, it became so weak that it could neither chew nor swallow, and of course could not move. It died on the thirty-second day of the experiment; and, on opening its body, there was a total absence of fat; the muscles were reduced to one sixth of their bulk, and the stomach and intestines were much contracted. The gall and urinary bladder were both filled with fluid; but on analysis, the bile and urine resembled those of herbivorous animals. The urine, instead of being acid, as in those which eat flesh, was like that of herbivorous animals, sensibly alkaline, and did not contain a trace of uric acid or the phosphates, while the bile contained the picromel so remarkable in ox gall. The excrements also contained much less azote than usual. This experiment was twice repeated, with nearly the same result.

Olive-oil was next tried with two healthy young dogs, which seemed to agree with them for the first fifteen days, but then produced the same bad effects, and both died on the thirty-first day.

Gum was given to several dogs, and always with the same result.

Butter, an animal substance, but which does not contain azote, was also tried; and although, after the thirty-second day, the dog was allowed as much meat as it could eat, it died on the thirty-sixth day, similarly affected.

M. Magendie also killed several dogs at a proper period, after they had got a full meal of oil, sugar, or gum, in order to observe the nature of the chyle thus furnished. The chyle of the oil was of a decided milky white, whilst those of the gum and sugar were transparent, opaline, and more watery. These experiments, in M. Magendie's opinion, render it doubtful whether the oils, fats, gum, and especially sugar, are so nutritive as is generally supposed. But before we adopt his conclusion, we must remember that whole nations subsist upon food which contains

very little if any azote. The Hindus live almost entirely upon rice, the peasants of Lombardy upon maize, those of Ireland upon potatoes, the slaves in the West Indies get fat during the cane crop, and the negroes of Senegal during the gum harvest, and herbivorous animals are nourished at all times upon grass. M. Magendie is not ignorant of these facts, but tries to explain them away by doubting the accuracy of some of the relations, and alleging that few vegetables are altogether destitute of azote. He cites, in confirmation of his observations, the experiments of Dr Stark, who injured himself by trying to live on sugar, bread, and water; and of M. Clouet, who grew extremely weak upon potatoes and water; and instances the insufficiency of sugar and a little rum to support the crew of a shipwrecked Hamburg vessel. The legitimate conclusions from all the facts relating to this subject seem to be,

1. That animals derive the azote which enters into their composition entirely from their food, and hence that no animal can live for a considerable time upon food totally destitute of azote.

2. That animals, even those naturally carnivorous, can live a certain time upon food entirely destitute of azote, in consequence of which the excretions of the naturally carnivorous become altered, and throw off less azote than when fed on animal food, acquiring the properties which these excretions have in animals whose food contains a very small proportion of azote.

3. That vegetable and animal substances destitute of azote are highly nutritious, provided, at the same time, azote be supplied from the admixture of some other aliment containing it, though in small proportion.

Upon these principles, alimentary substances may naturally and philosophically be divided into three great classes.

I. Those which contain azote, carbon, hydrogen, and oxygen.

II. Those which contain carbon, hydrogen, and oxygen.

III. Those which contain neither azote nor carbon.

I. *Alimentary Principles which contain Azote, Carbon, Hydrogen, and Oxygen.*

The aliments which contain azote correspond with the animal substances in general, and are calculated to repair the waste of our solids and fluids, without great alteration or effort in the digesting organs. All the immediate principles of this class are not, however, equally digestible, or possessed of the same properties. We shall say a few words of each.

Fibrin constitutes the great mass of the solid matter of the muscles of animals, especially of those which are old and have dark-coloured dry flesh. It is also a principal constituent of the blood of all animals. There can be no doubt, therefore, that it is pre-eminently nutritious in these its natural forms of combination, but we know of no experiments to ascertain its nourishing powers when used alone. The purest form of fibrin which occurs in common circumstances is the fibre of flesh which has been long boiled in a great quantity of water, as in the remains of the meat from which beef-tea is made, or of that boiled down for soup. This is generally considered, and is often thrown away, as totally indigestible, and deprived of all its nourishing principles; but this is probably a vulgar error, for animal fibre in this state still contains, as much as ever, all the elementary substances which are necessary for animal food; and the only circumstance which can account for their indigestibility, is their great aggre-

¹ *Mémoire sur les propriétés nutritives des substances qui ne contiennent pas d'azote*, 8vo, Paris, 1816.

Dietetics. gation, which it is the business of cookery to overcome. Fibrin also forms a large proportion of the substance of some of the internal organs of animals, all of which are nutritious. Pure fibrin is white and opaque when moist, but acquires a dark colour on being dried. It does not become putrid when kept in the air, nor even when immersed in water for a considerable length of time. It contracts and shrinks on the application of heat, and gives out, on being burnt, the smell of burning horn or feathers. It is insoluble in cold water; is corrugated by boiling in water; is insoluble in alcohol; but strong acetic acid swells it considerably, and renders it transparent like cartilage, in which state it may be dissolved, or, at least, diffused through water by long boiling.

Fibrin varies in every species of animal, and in the same animal at different ages, either from a difference in its nature, or from a difference in the matter with which it is combined. In many fishes, and the lower classes of animals in general, it is semitransparent and colourless. In veal, pork, salmon, chicken, and some other kinds of poultry, it has a pink colour; in beef and mutton it is of a fuller red; and in pigeon and game, both birds and quadrupeds, it is dark coloured. In general it is more tender in the female than in the male, and in the young animal than in the old.

Albumen is also a principal constituent of animal substances, in which it exists in two states, one uncoagulated and the other coagulated. Of the former, the purest example occurs in the raw white of eggs. Cartilage, horn, hair, nails, consist chiefly of the latter. It is also a principal constituent of blood and brain; and it seems to be the chief substance of oysters, mussels, and snails. Uncoagulated albumen is sometimes solid, often glairy, always transparent, and, when fluid, is soluble in water, and its taste is bland or almost insipid. At 165° Fahrenheit it is converted into a white solid mass, of which we have a familiar example in the white of a hard-boiled egg. There can be no doubt that albumen, especially in its uncoagulated state, is highly nutritious and easily digestible.

The curd of milk may be considered as a variety of albumen, although it possesses some peculiar properties, especially that of being converted into cheese by a particular mode of management.

Gelatin is a third very principal constituent of animal solids, as bones, ligaments, tendons, membranes, skin, muscles, &c. and exists in much larger proportions in the flesh of young than of adult animals. Thus we see the gravy of veal and lamb always gelatinize, while that of beef and mutton does not. The swimming bladder of the several species of sturgeon is gelatin in a state of very great purity, and by boiling it may be extracted pure from the shavings of hartshorn. Its taste is bland and nearly insipid. It is characterized by its solubility in water, being much increased by a boiling temperature, and by the solution, when of a certain strength, gelatinizing on cooling. It is highly nutritious, and supposed to be the most easily digestible of animal matters.

Mucus differs from albumen chiefly in not being coagulated by heat or corrosive sublimate, and from gelatin in not being precipitated by vegetable astringents, nor gelatinizing when its solution is concentrated. It exists nearly pure in saliva, and is a constituent of most of the secretions. There can be no doubt of its easy digestion and nutritious quality.

Of these four principal constituents of animal matter we may remark, that in themselves they are almost insipid; that gelatin exists almost entirely in a solid form, more or less dense; that mucus and albumen exist in every form of aggregation, from perfect fluidity to the density of cartilage; and that fibrin is only fluid in the

living blood, but in every other instance is a tough solid: *Dietetics.* and that gelatin is very soluble in boiling water, and gelatinizes on cooling; that albumen is soluble in cold water, and coagulates at 165°; and that fibrin is not soluble either in cold or hot water. We may also remark that, although chemists have given very definite characters of each, as if they constituted absolutely distinct species of matter, these characters are taken from certain selected kinds of each, and that, in reality, we find that there is a regular and insensible gradation from mucus, through gelatin and albumen, to fibrin; and that, as in the process of animalization, as well as in the progress of life, they pass into each other, and many intermediate states are found which cannot be distinctly referred to any of them.

Osmazome, or animal extractive, differs very much from the preceding principles; chemically, in being soluble in alcohol, and to the senses, in being very savoury or sapid. It is upon this, which seems to admit of considerable varieties, that the flavour of animal food, and of each of its kinds, depends. It exists chiefly in the fibrous organs, or combined with fibrin in the muscles, while the tendons and other gelatinous organs seem to be destitute of it. The flesh of game and old animals also probably contain it in greater quantity than that of young animals abounding in gelatin.

Gluten is the only vegetable substance which contains a notable proportion of azote in its composition. When separated from other principles, it forms a tough, ductile, elastic, and tenacious mass of a gray colour, resembling, when drawn out, thin animal membrane; when dried it is brittle, hard, and slightly transparent, like glue. When kept moist it ferments and acquires some of the properties of cheese. Immersed in water it at last putrefies. When burnt or distilled it resembles in its properties horn or feathers. It is soluble in concentrated acetic acid, and, by the assistance of heat, in muriatic acid and in the alkalis. It then bears a strong analogy to the animal substances in general, resembling, by different properties, fibrin, albumen, and gelatin. It is very generally found, though only in a small proportion, in the vegetable kingdom, in all the farinaceous seeds, in the leaves of cabbages, cresses, &c.; in some fruits, flowers, and roots, and in the green feculum of vegetables in general; but it is particularly abundant in wheat, and imparts to wheat-flour the property of fermenting and making bread. On the nutritious powers of gluten separated from other principles nothing certain is known; but the superior nutritious powers of wheat-flour over that of all other farinaceous substances sufficiently proves that, in combination with starch, it is highly nutritive; and in all probability it is the gluten of the green feculum which supplies the azote necessary for the support of the herbivorous animals.

II. *Alimentary Principles which contain Carbon, Hydrogen, and Oxygen.*

Starch is very abundantly diffused through the vegetable kingdom. It exists in great purity in various farinaceous grains, such as rice, barley, maize, and millet; it is combined with gluten in wheat; with saccharine matter in some grains, as oats, and in many leguminous seeds, such as haricot-beans, lentils, vetches, and peas; with viscous mucilage, in rye, potatoes, and Windsor beans; with fixed oil and mucilage in the emulsive seeds, such as nuts, almonds, cocoa, tamarinds, in linseed, rapeseed, hempseed, poppyseed, and, in general, all those from which an oil can be obtained by expression. Lastly, starch is sometimes united to a poisonous substance. Of this singular union of a nutritious with an injurious principle the most remarkable instance occurs in the roots of the Ja-

Dietetics. *tropa manihot*, and of many species of *arum*, to the former of which the negro slaves of the West Indies are indebted for their cassada bread, and from the latter is prepared the best arrow-root starch. Only one species of grain, the *Lolium temulentum*, is hurtful; but many leguminous seeds are poisonous, of which the most familiar example occurs in the laburnum peas.

Starch is artificially prepared in great purity from various substances. *Starch* is got from wheat and potatoes, *arrow-root* from various species of *arum*, *cassada-flour* from the manioc root, *salep* from the orchideæ in general, *sago* from the pith of various species of palm-trees, *tapioca* from the bitter and sweet cassava root. In all of these varieties of form, starch furnishes a bland and wholesome nutriment.

Gum or *Mucilage* is also a principal ingredient in the composition of our alimentary vegetables. The distinctive character of gum is its solubility in cold as well as hot water, and its insolubility in alcohol. It is devoid of smell, and to the taste it is bland and agreeable. In Arabia, Senegal, and the East Indies, it is obtained in great quantities from the various species of *Mimosa*, from the bark of which it exudes in great purity; and in hot climates in general it is furnished by many trees, especially those which have an astringent bark. In our own country an example of its production is seen on the bark of the plum and cherry trees. Where it is produced in sufficient quantity it constitutes a principal article of diet; and the Africans of Senegal are said to live entirely upon it during the gum harvest. Eight ounces of gum are the daily allowance, and furnish sufficient nourishment, for each man.

Mucilage is the alimentary principle of many of our esculent vegetables. In some it is united only to green colouring matter, as in the leaves of beet and spinach; with bitter matter, which may be prevented by the process of blanching, as in endive, lettuce, succory, and cardoon, or by using the plant very young, as in asparagus. It exists also in every part of the mallow tribe; in many roots, as scorzonera, salsafy, and Jerusalem artichokes, in the receptacle of the flower of the artichoke. It is combined with an acid in sorrel leaves; with saccharine matter in many fruits, as the fig and date; in roots, as the carrot, parsnip, and beet; and with slight acrimony in the turnip, cabbage leaves, cauliflower, and broccoli, and with considerable acrimony in the radish, cress, and mustard. It exists in great quantity, combined with a peculiar nauseous principle, in onions, garlic, shalot, leek, &c.; and, lastly, in small quantity, with much aroma, in those vegetables which are used only for seasoning, as parsley, thyme, &c. In short, it is very generally found throughout the vegetable kingdom, and in every mode of union with other principles.

Sugar, the common properties of which, in a state approaching to purity, are familiar, is also highly nutritious. It is crystallizable, soluble in water both cold and hot, in alcohol and the weak acids, readily undergoing, when dissolved in sufficient water, the vinous and acetous fermentation, but, on the other hand, when concentrated, preserving vegetable substances. Chemically considered, it presents many varieties. It exists in greatest quantity, combined with mucilage, in the juice of the sugar cane, of the maple tree, the manna ash tree, and of beet-root. It seems to be a constant attendant upon the inflorescence of vegetables, for almost every flower furnishes honey to the bee, and is a chief constituent of all the acerb, sub-acid, and sweet fruits, in combination with vegetable jelly. Sugar is produced, or at least collected, by several insects. To the bee we are indebted for honey; and a species of locust in New Holland covers the trees and ground with a kind of sugar. In all animals a principle having

some analogy with sugar exists in the bile, and it is a product of morbid action in the disease called diabetes.

Oil and fat are also nutritious. They differ most obviously in fluidity, and they coincide in being insoluble in water, and in containing a larger proportion of hydrogen than the alimentary matters already spoken of. The oils may be divided into the fluid and concrete, and both are furnished by the vegetable and animal kingdoms. Fluid oil exists in quantity in the emulsive seeds; in some of them combined with prussic acid, as in the bitter almond, and in others with an acrid matter, as in the seeds of the ricinus; but it is obtained in greatest quantity and purity from the olive. The animal fluid oils are all more or less nauseous, as spermaceti oil, seal oil, whale oil, and cod liver oil. The concrete oils are generally furnished by the animal kingdom, and these are often bland and agreeable when fresh, but are apt to become rancid in proportion as they are less solid. Butter is the least consistent, if we except the fat of some birds; then hog's lard, the subcutaneous fat of beef, and the kidney fat of beef and mutton in succession. The only concrete oil obtained from the vegetable kingdom is the butter of cocoa.

III. Alimentary Principles which do not contain Carbon.

Water is perhaps the only real alimentary substance which belongs to this class, but it is one of the most essential. It is not only necessary to replace the constant waste of water which is drained off from our bodies, by the secretions, the cuticular discharge, and the vapour of the breath, but it is in itself strictly digestible, and capable of supplying either hydrogen or oxygen to the system, as may be required, according to the nature of our other food. When we consider how large a proportion of the whole weight of our bodies consists of water only, and that the fluids require more frequent renewal than the solids, the necessity of water as an aliment cannot be disputed. Some animals, as the rabbit, are supposed to be capable of living a long time or altogether without water; but this is a mere deception, for their vegetable food consists almost entirely of water. On the other hand, Dr Fordyce kept gold fishes six months in distilled water, and thought himself warranted in concluding that animals could live in water and air alone. Pouteau allowed some of his patients nothing but water for several weeks, without their falling off; and the histories of shipwrecked mariners prove with how small a portion of solid food man can subsist, provided he has sufficient allowance of water, whilst without water, or a substitute, no quantity of solid food can support man for even a few days.

Earths are, perhaps, not altogether unalimentary. Not to mention the depraved appetite of many young females, and of the dirt-eating negroes of the West Indies, for chalk, cinders, and such substances, earth is sought after and devoured by whole nations. The luxurious Capuans paid a considerable tribute to the Neapolitans for an earth called *Leucogæum*, which they considered necessary for the preparation of a favourite dish, *Alica*. The Tungusses, according to Laxmann, eat a fine clay with rein-deer's milk. Chandler saw the women and children in Samos chewing pieces of steatite as a luxury. La Billardiére saw the same practised in New Caledonia, and found edible earth sold in the market in several villages in Java. Throughout all India lime is used along with the betel leaf. Kepler partook of the butter earth, which is eaten with great relish, spread upon bread, by the millstone quarriers of Thuringia; and, lastly, Humboldt has made us acquainted with the existence of a whole nation of earth-eaters, the Ottomacs on the Orinoco.¹ We may

¹ Tableaux de la Nature. Par A. Humboldt, 2 tomes 12mo, Paris, 1803.

Dietetics. also mention that bird-fanciers find it necessary to supply birds shut up in cages with sand and earth. All these facts, we are aware, might be explained upon principles different from the digestibility of the earthy substances taken into the stomach; and we have no idea that any earthy substances can supply carbon or azote to the system; but we have absolute proof that earthy matter may enter into the circulation, in the growth and absorption of the bony frame of our body, for which phosphate of lime is as necessary as carbon or azote for our soft solids.

Sea Salt is more obviously necessary than earth. Even in insular and maritime situations it is voluntarily used as a condiment by all; but it is only in inland countries, at a distance from the sea, that its necessity is duly appreciated. Muriate of soda enters into the composition of all our fluids, and is thrown off by many of our secretions; hence its waste must be supplied, and where the vegetables are not naturally impregnated with it, it becomes one of the most indispensable articles of our food.

Alimentary substances, as presented to us by nature or prepared by art, may be considered in various points of view.

Digestibility of various alimentary substances. They differ in regard to digestibility, or the facility with which they are decomposed by the powers of the stomach, to enter into new combinations fitted to repair the waste of the blood. In this particular, also, they may differ in respect to the length of time, or in regard to the digestive power of the stomach, required for their digestion. Thus the digestion of one substance may be slow, though ultimately complete, even in a weak stomach, and that of another quick enough in a strong stomach, although imperfectly digested by one that is weak. In reference to their digestibility, aliments are commonly described as being light or heavy; but in this respect there is very great difference in regard to different individuals, the same substances being light to one and heavy to another, and *vice versa*.

Sir Astley Cooper made some experiments to ascertain the comparative digestibility of different kinds of raw meat without fat; and the following table exhibits the loss 100 parts of each sustained in the stomach of dogs, which were killed, one, two, three, and four hours after being fed.

Pork.....	10.....	20.....	98.....	100
Mutton...	9.....	46.....	87.....	94
Beef.....	0.....	34.....	37.....	75
Veal.....	4.....	31.....	46.....	69

In another experiment, after four hours, the digestibility appeared in the following order,—cheese, mutton, pork, veal, beef. Fat appeared to be also much more digestible than cheese; beef than potato, and codfish than beef. Boiled veal was much more digestible than roast; and of different parts of the same kind of food, the digestibility was in the following order,—fat, muscles, skin, cartilage, tendon, and bone.¹ From the experiments detailed in the inaugural dissertation of Dr Macdonald, *De Ciborum Concoctione*, Edinburgh, 1818, which were made in company with the late Dr Gordon, there appears to be great irregularity in the time necessary for the completion of digestion, so that they scarcely furnish any conclusion as to the comparative digestibility of different substances. Dr Macdonald infers that, of those he tried, butter was the most, and rice the least, digestible in the stomach of the dog. In the experiments which Dr Stark made upon

himself, to ascertain the nutritious properties of oily substances, he found that, with a daily allowance of thirty ounces of bread and three pounds of water, two ounces of olive oil taken at one meal was so large a quantity as to be disagreeable; three ounces in the day caused some uneasiness in his bowels; and four ounces griped him very much, although he gained weight; but this experiment was not conclusive, as at that time he was suffering under sloughing gums, the effects of a protracted diet of sugar. A diet of four ounces of pure fat, obtained from the subcutaneous fat of beef, made into a pudding, with twenty ounces of flour, and twelve or twenty ounces of water, with the remainder of three pounds of water in drink, was both nourishing and agreeable; but when the fat was increased to six ounces, great part of it passed unassimilated, and his bowels were affected. The same pudding without the suet was not sufficiently nutritious, and did not satisfy his appetite in the same manner. When the pudding was made with butter, although only four ounces were used, he was made very ill by it. Oil of butter agreed very well; and oil of marrow, of all the fats Dr Stark tried, he found to be the mildest in the bowels. His gums having again become purple and swelled, with petechial appearances on his body, while making these experiments, suggested to him the following queries, which seem important to the science of dietetics. “Although at present I take more food than what is absolutely necessary for the support of the body, I remain perfectly well, whereas I have several times suffered considerable inconvenience from committing any excess in the quantity of oils. Is it not evident that excess in the quantity of oils is more hurtful to the body than excess in any other article of food? and that, of course, we ought to be particularly careful in regulating the quantity and quality of the oils we may employ in diet? Is it not probable, then, that animal oils, though they nourish and increase the weight of the body, are not of themselves sufficient to prevent a morbid alteration from taking place in the blood and fluids? whilst, on the other hand, the lean of meat, though less nutritious, is of more efficacy in preserving the fluids of the body in a sound state.”²

Aliments also differ in regard to the proportional quantity of nourishment they furnish, and, in this point of view, they are said to be strong and weak, or rich and poor. This difference may arise either from the proportional quantity of digestible and indigestible parts in the various kinds of aliment, or from the digestible parts being different in kind, and furnishing a supply of a different kind to the blood. There is even in this respect some opposition between light food and strong food, and it may be generally observed, that food which is most quickly digested, requires the soonest to be repeated, while digestible food, that is only slowly digested, supports the body for a greater length of time.

Aliments also differ in the impression they make on our palate; and it is chiefly in this respect that they are considered by the epicure. This impression proceeds from two distinct qualities in the aliment; the one depending upon their grosser physical properties, and the other upon their finer, recognizable only by the senses of taste and smell. To the former class belong the sensations of solid and fluid, hard and soft, tough and tender, crisp and stringy, hot and cold, greasy, glutinous, gritty, smooth, &c. These are judged of by the tongue and palate, rather

¹ A Treatise on the Nature and Cure of Gout and Rheumatism, including General Considerations on Morbid States of the Digestive Organs; some Remarks on Regimen, and Practical Observations on Gravel. By Charles Scudamore, M. D. 8vo, London, 1817.

² The Works of the late William Stark, M. D. consisting of Clinical and Anatomical Observations, with Experiments Dietetical and Statistical, revised and published from his original Manuscripts. By James Carmichael Smyth, M. D. 4to, London, 1788.

Dietetics. as organs of touch than of taste, and are altogether independent of flavour, as capable of affecting the organs of taste and smell. The latter class consists of all the variety of tastes properly so called, namely, sweet, bitter, sour, salt, alkaline, astringent, aromatic, nauseous, pungent, acrid, spirituous, cooling, &c., and also the want of taste, the vapid or mawkish. Of these, some are almost universally agreeable, and others generally disliked; but much depends upon idiosyncrasy, state of health, education, habit of the individual, and upon the degree or quantity of flavour.

Aliments also differ in the impression made upon the stomach; but the sensations arising from this source are more obscure and less varied. Except the sensation of heat, which may arise from caloric, and is transient, or from acrimony or spirit, which is more durable, most of the sensations experienced in the stomach are indications of its mechanical state, or of affections of the appetite. Hence we have the feeling of gratification, from removal of a sense of emptiness, of repletion, distension, cessation of hunger or thirst, satiety, and sickness.

General
observa-
tions on
diet.

We should also consider the effect of different kinds of diet, when the body is in a state of health, and different states of disease; but accurate experiments are still wanting to enable us to give any thing more than fragments of this interesting subject. It is extremely difficult to institute these experiments satisfactorily. They are irksome to the person on whom they are tried; and so many causes tend to interfere with the results, that it is only by frequent repetition that the real effects can be fairly deduced.

Our diet may be either proper, or it may err, and this either in quantity or quality. When the quantity is too small, the body is not nourished; it becomes lean, the fat disappears, and the muscles either get soft and flabby, or shrivelled and dried up, accompanied by loss of strength or stiffness, with predisposition to an actual disease. Errors in regard to the quantity of food are merely relative; so much depends upon circumstances, as individuality of constitution, period of life, state of health, degree of mental and corporeal exertion, habit and temperature. Each person may be said to have a different standard quantity, deviations from which are to be accounted errors. In our army, the rations allowed for each soldier at home are, three quarters of a pound of meat, boiled so as to afford broth, with $1\frac{1}{2}$ d. worth of potatoes and other vegetables, one pound of bread, or one and one eighth pound of oatmeal; and in most cases one pound of milk or coffee is purchased for his breakfast. On service the rations are, one pound of meat, one and a half pound of bread, and one pint of wine or one sixth of a pint of spirits.

Mr Buxton states that the diet allowed to the prisoners in the jails in London varies from fourteen ounces of bread per day, and two pounds of meat per week, which, he says, is not enough to support life, up to one pound and a half of bread, one pound of potatoes, two pints of hot gruel, and either six ounces of boiled meat, without bone, and after boiling, or a quart of strong broth, mixed with vegetables, per day, which is as much more than enough; and Mr Buxton thinks that the meat should be discontinued. A fit prison diet, in his opinion, should consist of one pound and a half of bread, at least one day old, to each prisoner, daily, and one pint of good gruel for breakfast; and, upon good behaviour, half a pound of meat on Sundays.¹

Some experiments have been made in order to ascertain the quantity of different kinds of food necessary for the sustenance of individuals. Dr Franklin, when a journeyman printer, lived a fortnight on bread and water, at the rate of ten pounds of bread a week. Dr Stark, whose weight was 171 pounds avoirdupois, found that thirty-eight ounces of bread daily were not more than sufficient to satisfy his appetite; forty-eight ounces were the utmost he could consume in one day, and the greatest quantity he could take at one meal, without uneasiness, was thirty ounces; and, with this diet, he required necessarily three pounds of water for drink, for with only two pounds he was not satisfied. In another experiment, thirty ounces of bread and three pounds of water, with six ounces of boiled beef, sufficed: with four ounces of the beef his appetite was not satisfied; with two pounds of bread and three pounds of infusion of tea, he found that one pound of cold stewed beef was not more than sufficient: he was not satisfied with four ounces of beef to breakfast; but eight ounces at dinner, and four ounces at supper, were rather too much.

Absolute starvation produces diminished excretions, fetid breath, foul skin, and death. The most distressing histories of this dreadful end are recorded in the account of shipwrecks, and of those unfortunate persons who fall into the hands of the Arabs of the desert. Man can sustain the absolute want of food for several days, more or fewer in number according to circumstances; the old better than the young, and the fat, probably, better than the lean. The total want of drink can be borne only a very short time, and its effects are even more distressing than those of want of food. They have been strikingly described by Mungo Park and by Ali Bey, as experienced in their own persons. The narratives of shipwrecked mariners also prove with how very little food life may be supported for a considerable length of time; and the history of those impostors who pretend to live altogether without food or drink display this adaptation of the wants of the body to its means of supply in a still more striking manner; for, even after the deception in such cases as that of Ann Moore is exposed, it will be found that the quantity of aliment actually taken was incredibly small.²

Captain Woodard has added to his interesting narrative many instances of the power of the human body to resist the effects of severe abstinence.³ He himself and his five companions rowed their boat for seven days without any sustenance but a bottle of brandy, and then wandered about the shores of Celebes six more without any other food than a little water and a few berries. Robert Scotney lived seventy-five days alone in a boat, with three pounds and a half of meat, three pounds of flour, two hogsheads of water, some whale oil, and a small quantity of salt. He also used an amazing quantity of tobacco. Six soldiers deserted from St Helena in a boat on the 10th of June 1799, with twenty-five pounds of bread and about thirteen gallons of water. On the 18th they reduced their allowance to one ounce of bread and two mouthfuls of water, on which they subsisted till the 26th, when their store was expended. Captain Inglefield and eleven others, after five days of scanty diet, were obliged to restrict it to a biscuit divided into twelve morsels for breakfast, and the same for dinner, with an ounce or two of water daily. In ten days, a very stout man died, having

¹ An Inquiry whether Crime or Misery are produced or prevented by our present System of Prison Discipline. By Thomas Fowell Buxton, M. P. 12mo, Edinb. 1818.

² An Examination of the Imposture of Ann Moore, called the Fasting Woman of Tutbury, illustrated by Remarks on other Cases of Real or Pretended Abstinence. By Alexander Henderson, M. D. 8vo, London, 1813. Also, Rev. Leigh Richmond, in Medical and Physical Journal, by Samuel Fothergill, M. D. and William Royston, 469, vol. xxix. 8vo, London, 1813.

³ The Narrative of Captain David Woodard and Four Seamen. 2d edit. 8vo, London, 1805.

Dietetics. become unable to swallow, and delirious. Lieutenant Bligh and his crew lived forty-two days upon five days' provisions.

In the tenth volume of Hufeland's *Journal*, M. Gerlach, a surgeon-major of the Prussian army, has related a very remarkable and well authenticated case of voluntary starvation. A recruit, to avoid serving, had cut off the forefinger of his right hand. When in hospital for the cure of the wound, dreading the punishment which awaited him, he resolved to starve himself, and on the 2d of August began obstinately to refuse all food or drink, and persisted in this resolution till the 24th August. During these twenty-two days he had absolutely taken neither food, drink, nor medicine, and had no evacuation from his bowels. He had now become very much emaciated, his belly was somewhat distended, he had violent pain in his loins, his thirst was excessive, and his febrile heat burning. His behaviour had also become timid. Having been promised his discharge unpunished, he was now prevailed upon to take some sustenance, but could not at first bear even weak soup and lukewarm drinks. Under proper treatment he continued to mend for eight days, and his strength was returning, when, on the 1st of September, he again refused food, and assumed a wild look. He took a little barley water every four or five days to the 8th; from that day to the 11th he took a little biscuit with wine; but again, from the 11th September to the 9th October, a period of twenty-eight days, he neither took food, drink, nor had any natural evacuation. From the 9th to the 11th he again took a little nourishment, and began to recruit; but, on the 11th, he finally renewed his resolution to starve himself, and persevered until his death, which took place on the 21st November, after a total abstinence of forty-two days.

On the other hand, the quantity of nourishment which can be devoured with impunity is often very great. Almost every person in good circumstances eats more than is necessary for supporting his body in a state of health, and many bring their stomachs to require a very excessive allowance as almost necessary. In some individuals an inordinate appetite seems constitutional. Charles Domery, aged twenty-one, six feet three inches high, and well made, but thin, when a prisoner of war at Liverpool, consumed in one day four pounds of cow's udder and ten pounds of beef, both raw, together with two pounds of tallow candles and five bottles of porter, and, although allowed the daily rations of ten men, he was not satisfied.¹ Baron Percy has recorded a still more extraordinary instance in a soldier of the name of Tarare, who, at the age of seventeen, being of moderate size, rather thin, and weighing only a hundred and seventy pounds, could devour, in the course of twenty-four hours, a leg of beef twenty-four pounds in weight, and thought nothing of swallowing the dinner prepared for fifteen German boors.² But these men were remarkable, not only for the quantity they consumed, but also for its quality, giving a preference to raw meat, and even living flesh and blood. Domery in one year eat 174 cats, dead and alive; and Tarare was strongly suspected of having devoured an infant, which disappeared mysteriously. Many other histories of the same kind are preserved; and although some of the individuals were men of large stature and great strength, others were of ordinary size. The excess of food may be taken either in the form of too much at one meal or of too many meals. It is either digested and furnishes an excess

Dietetics. of nourishment, or it passes through the canal simply indigested, or it undergoes the fermentation natural to it. An excess of nourishment either produces a great or rapid increase of the size of body generally, or of the fat and abdominal viscera in particular, or, by inducing great fulness of blood, produces diseases which sometimes counteract the effects of the plethora. When the excess passes simply indigested, it only occasionally proves hurtful as a mechanical irritation in the bowels, especially when it is of a hard substance, and has sharp angles. When it undergoes its natural fermentation this is either acid or putrid, as the substance is vegetable or animal, or rather as it is destitute of or contains a notable proportion of azote.

When diet errs in quality, it gives rise to a greater variety of cases. It may either produce a directly hurtful effect upon the constitution, in the manner of a poison or medicine, in its natural state, or after fermenting in the stomach; or it may prove injurious more indirectly by not supplying an element necessary for its healthy condition, or by supplying one in excessive proportion. The poisonous effects of alimentary substances are always occasional, and arise from a peculiarity in the aliment itself, as in the case of poisonous fishes, or in the individual, as in those persons who cannot eat particular kinds of food, which are to others wholesome and nutritious. The unpleasant effects of substances undergoing their natural fermentation in the stomach are much more frequently observed. They occur either from a very strong disposition in the food to ferment, so that the action of a healthy stomach is not able to restrain it, or from excess of the food, so that part of it is left to its natural changes, or from weakness of the stomach, which exerts little action upon it. Fermenting substances are hurtful, by acting as direct poisons, and by distending the stomach; in the non-azotized substances becoming acid and producing flatulencies, in the azotized substances becoming putrid and producing fetid eructations and flatus. Diet, which errs by supplying one of the elementary constituents of our body in excess, or in not supplying another, does not produce its full effects at once, but gradually changes the condition of the body. When an elementary principle is furnished in excess, it is thrown off by the various excretions, and hence we find that the urine of omnivorous animals, when confined to animal food, contains more urea, and their perspirations and stools are more fetid; while the urea disappears, and the stools and perspirations lose their fetor, when they are restricted to vegetables. The same observations have been made in regard to man. Also, when the supply of an elementary principle is deficient, it ceases to be thrown off by excretion, even after it has performed its functions in the body, but is re-absorbed, and thus the body, for a time, lives as it were upon itself.

The chief varieties of diet, in regard to quality, depend upon their immediate effects, and in this respect they may be divided into the simply nutritious and the stimulant. All animal flesh seems to be more or less stimulant, and, in general, the more so the darker its colour is; and upon this principle chiefly has Dr Darwin founded his classification of aliments, but he has erred in considering them as also more nutritious. Moor-game, pigeon, hare, and venison, are more stimulating, but perhaps not more nutritious, than the turkey or barn-door fowl, veal, or lamb. The effect upon the composition of our bodies is the secondary but most important effect. In this respect, food

¹ Account of a Man who lives upon large quantities of Raw Flesh, by Dr Johnston; in the Medical and Physical Journal, by Drs Bradley, Beatty, and Nohden, vol. iii. 8vo, London, 1800.

² Mémoire sur la Polyphagie. See Journal de Médecine, Chirurgie, et Pharmacie, par MM. Corvisart, Leroux, et Boyer, tome ix. 8vo, Paris, An. xiii.

Dietetics. might be divided into the azotized, hydrogenous, carbonaceous, and oxygenous, or rather into those which supply abundantly azote, hydrogen, carbon, and oxygen. This view is, however, chiefly theoretical, as we are very far from possessing facts enough to establish it completely, or to overturn it; but yet there are some which favour it. We have already noticed Magendie's experiments on substances which do not contain azote, from which he inferred that a certain supply of it was absolutely necessary to the support of animal life. Other facts lead to the same conclusion, especially the effect of restriction to one kind of aliment in the generation and cure of disease.

It is many years since Dr Rollo¹ was led, by the singular sweetness of diabetic urine, to conclude that, if he deprived the patient of all food which contained sugar, or the principles of sugar, he should be able to cure this hitherto untractable disease. He accordingly restricted his patients to the use of animal food, especially fat, and absolutely prohibited all vegetables, even bread, and all fermented liquors. The effects were very striking, and some patients were believed to be cured; at least the nature of their urine was completely altered from a morbid to a healthy state. As conducted by others, the same regimen has produced the same effects; but it is so disagreeable to the patients that they can seldom be prevailed upon to adhere to it, and unfortunately, notwithstanding the temporary removal of this prominent symptom, the disease generally continues its fatal course. We may, however, notice, that Rollo and others were guided in their choice of regimen by the principle of withholding the elements of sugar, and hence fat formed a chief part of it, and was a principal cause of the disgust it excited; but perhaps it would be better to select a highly azotized diet, in which point of view the muscular parts of dark-fleshed animals, such as game and old mutton, and those kinds of fish, such as skate, which contain much azote in a loose state of combination, should be selected; while wheaten bread, the want of which is so distressing to many, might be allowed, and fat, which contains no azote, should not be prescribed.

Magendie² ascribes the gravel to the superabundance of azote in our food, as the uric acid of which gravel consists is a highly azotized substance, and seems to be produced as a means of throwing off the excessive azote; and among the various causes with which gravel is connected, the most active in its agency is high living, or the use of animal food in excess. A Hanseatic citizen, who kept a good table previous to 1814, was afflicted with the gravel. He emigrated and lived very miserably in England, but his gravel completely left him. He re-established his affairs, and with his fortune his gravel returned. Again he was ruined, and went to France almost destitute, and his gravel disappeared. By industry he finally acquired a competency, and with it his old complaint, for which he then consulted Magendie. A Parisian lady of sixty, subject to gravel, read in a journal a short notice of Magendie's experiments, in which it was said that he had discovered in sugar a cure for the gravel. Without more advice she set about eating sugar, often to the extent of a pound daily, and in effect she removed the gravel, but disordered her stomach so much that she was obliged to resume her usual food, and with it the gravel returned.

Dietetics. The chemical theory of the scurvy is, that it is owing to the want of oxygenous food; and it cannot be denied that this theory has been very ingeniously supported by Dr Trotter, Dr Beddoes, and others. The rapidity with which those afflicted with it recover by the use of recent vegetables, especially the fresh citric acid, shows that it proceeds from an error in diet, but whether from a deficiency of nourishment in general, or from a deficiency of oxygenous aliment, is not quite so clear. When we compare the accounts of the ravages formerly committed by this dreadful disease, even during short voyages, with the almost total immunity which the British fleet has enjoyed since the time of Captain Cook, we have the strongest possible proof of the influence of diet upon the human frame, either as inducing or preventing disease.³

Hydrogenous food, such as the excessive indulgence in fat meat, butter, and oil, and still more especially in spirituous liquors, produces a change in the chemical constitution of our bodies, independently of the exhaustion of excitability by excess of stimulus. Bilious diseases, and a tendency to unwholesome fatness, are its most common effects; and it is only in the excessive hydrogenation of the system that we can find a rational explanation of that very singular phenomenon called the spontaneous combustion of the body; for even admitting that the clothes are accidentally set on fire in these cases, there appears no reason to doubt that the combustion is continued by the burning of the body itself. Now the greatest number of instances have occurred in old women addicted to the abuse of ardent spirits.⁴

The effects of oxygenous food, in imparting oxygen to the body, are not so well ascertained. Acids, and the subacid fruits, quench thirst, and are supposed to reduce animal heat; but their more obvious action is to affect the bowels and induce diarrhoea, and ultimately to render the body spare and thin. The new chemical pathology led to the exhibition of nitric acid for the cure of syphilis, as mercury was supposed to act by oxygenizing the system; and this acid has since been much employed also, from analogy, in the liver complaint. That the acid has excellent effects as a tonic, seems to be perfectly ascertained. It does not act upon the bowels like the vegetable acids, but there is no proof of its decomposition in the stomach, or of its imparting oxygen to the body. The oxygenizing of the system by means of the nitro-muriatic or oxymuriatic bath, now so fashionable in London, is a mere chimaera. Pulmonary consumption was also, at one time, considered as a disease proceeding from superabundant oxygen, and the florid colour of the cheeks was adduced in proof of it.

No observations have yet been made on the effects of aliments containing an unusually large proportion of carbon, nor has any disease been ascribed to the carbonization of the system.

It would extend this article much beyond the space we can allot to it, if we were even hastily to sketch the varieties of diet recommended in disease, and to explain their action; but it will not be superfluous to enter a little into the detail of that kind of regimen which has been found by experience to bring animals and man to the highest possible state of health, at least as measured by

¹ An Account of two Cases of Diabetes Mellitus. By John Rollo, M. D. 2 vols. 8vo, London, 1747.

² Recherches Physiologiques et Médicales sur les Causes, les Symptômes, et le Traitement de la Gravelle, 8vo, Paris, 1818.

³ Observations on the Scurvy. By Thomas Trotter, M. D. 8vo, Lond. 1792. Observations on the Nature and Cure of Calculus, Sea Scurvy, Consumption, Catarrh, and Fever; together with Conjectures upon several other subjects of Physiology and Pathology. By Thomas Beddoes, M. D. 8vo, London, 1793.

⁴ An Essay, Medical, Philosophical, and Chemical, on Drunkenness, and its Effects on the Human Body. By T. Trotter, M. D. 8vo, London, 1804. Essai sur les Combustions Humaines produits par une long abus des liqueurs spiritueuses. Par Pierre-Aimé Lair, 12mo, Paris, 1801.

Dietetics. the amount of their physical force, and their power of continuing its exertions. It is to bring animals to this state that constitutes the business of *trainers*, as they are called. Cocks, greyhounds, race-horses, and men, are much more active and vigorous after being trained than in their ordinary condition. They are, in fact, in a higher state of health; and we are fully convinced that, by training, many diseases might be removed, and by living according to the same principles, general ill health might be commonly prevented. The public is very much indebted to Sir John Sinclair for having taken the pains to collect the fullest information on this subject.¹ He was assisted in his inquiries, we have reason to believe, by Mr John Bell, whose attention was directed to the subject by having the professional care of Captain Barclay during his great walking-match. From the answers procured to Mr Bell's inquiries, it appears that the whole secrets of training reduce themselves to principles which every man may practise, and ought to practise, as far as is consistent with his business and other duties; and, in particular, we think that they ought to be studied, thoroughly understood, and enforced, by all those to whom, in consequence of accidental circumstances, the care of the health and lives of many individuals are intrusted. We allude chiefly to military and naval officers, and the proprietors of large manufactories. In the British navy the importance of this subject has been long appreciated; and the comparative state of health of our fleets, in recent times, is as honourable to our naval commanders as the laurels of victory which encircle their brows. Soldiers are left more to themselves, and their officers have neither the same control nor responsibility; but we think that more might be done in keeping the troops, as well as the military horses, when at home or in garrison, always in a state fit for active service. The evil of not attending to this was very severely experienced during the Spanish campaigns. The artillery horses sent from Chatham were found to be unfit for the fatigues of service, and good cart-horses were at last substituted with great advantage. In garrison both men and horses are over-fed and under-worked. In manufactories the opposite evils sometimes occur; the workmen, and especially the children, are over-worked and under-fed. This subject has lately occupied the attention of parliament; and it is connected with some interesting inquiries, which belong properly to the science of political economy. In a medical point of view, the principle to be followed is, that the food and labour bear a just proportion to each other. When the quantity and quality of the food is not limited by its expense, the best possible condition of the individual is attainable, by attending to the principles upon which training is conducted, and which resolve themselves into temperance without abstemiousness, and regular exercise in the open air. Mr Jackson says, that a man properly trained feels himself light and *corky*, as the technical phrase is; and that, during a course of training, the skin always becomes clear, smooth, well coloured, and elastic; or that cleanness of skin is the best proof of a man being in good condition. Another very striking effect of training is upon the lungs. Trained men can draw a much fuller inspiration, and retain their breath longer, than others. But it is not only on the state of bodily health that the good effects of training are conspicuous; for Mr Jackson distinctly, and we believe correctly, states, that the mental faculties are always improved, the attention is more ready, and the perceptions are more acute. From these observations some valuable hints may be derived by physicians, for the cure of many cutaneous and pul-

monary affections, which obstinately resist the power of Dietetics. medicines.

Cookery is strictly a branch of dietetics, and one of the most important. Only a small part of our food is consumed as it is furnished by nature. Many alimentary substances are disagreeable, and some even poisonous, until they have undergone certain preparations. Few of them are to be had at all seasons of the year, although produced at others in greater quantity than can be consumed; and all of them occur of very different qualities. Hence the selection, preservation, and preparation of alimentary substances, are arts of primary importance in life.

We hold the contempt with which cookery is very generally spoken of to be downright affectation, we had almost said hypocrisy; for, in the practice of life, every individual who is not perfectly imbecile and devoid of understanding is an epicure in his own way. The epicures in the boiling of potatoes even are innumerable; and every school-boy in Scotland passes a judgment on the culinary skill of the servant who makes his porridge. Cookery only becomes truly degrading when it occupies an undue proportion of attention; and that epicurism is to be utterly condemned which produces more pain than pleasure. Boswell, the biographer of Johnson, has defined man to be a cooking animal; and, in fact, man is the only animal which does not consume his food as presented to him by nature. We are not from this to conclude that man in cooking deviates from the ordinary course of nature; but that the appetite for cooked food is given to him for wise and useful ends. Count Rumford has not considered the pleasure of eating, and the means that may be employed for increasing it, as unworthy the attention of a philosopher.

"The enjoyments which fall to the lot of the bulk of mankind are not so numerous as to render an attempt to increase them superfluous. And even in regard to those who have it in their power to gratify their appetites to the utmost extent of their wishes, it is surely rendering them a very important service to show them how they may increase their pleasures without destroying their health.

"If a glutton can be made to gormandize two hours upon two ounces of meat, it is certainly much better for him, than to give himself an indigestion by eating two pounds in the same time.

"The pleasure enjoyed in eating depends first upon the agreeableness of the taste of the food; and, secondly, upon its powers to affect the palate. Now there are many substances extremely cheap, by which very agreeable tastes may be given to food, particularly when the basis or nutritive substance of the food is tasteless; and the effect of any kind of palatable solid food (of meat, for instance) upon the organs of taste, may be increased almost indefinitely, by reducing the size of the particles of such food, and causing it to act upon the palate by a larger surface. And if means be used to prevent its being swallowed too soon, which may be easily done by mixing with it some hard and tasteless substance, such as crumbs of bread rendered hard by toasting, or any thing else of that kind, by which a long mastication is rendered necessary, the enjoyment of eating may be greatly increased and prolonged.

"The idea of occupying a person a great while, and affording him much pleasure at the same time, in eating a small quantity of food, may perhaps appear ridiculous to some; but those who consider the matter attentively will perceive that it is very important. It is, perhaps, as

¹ The Code of Health and Longevity, vol. ii. Appendix, No. IV. 8vo, Edinburgh, 1807.

Dieu
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Diffarra-
tion.

much so as any thing that can employ the attention of the philosopher."

But we shall consider cookery in another point of view, and that one, the importance of which will not be denied by the most austere philosopher. The political economists have extolled agriculture above all other arts, and have obtained the assent of mankind to their dogma, that he who makes two blades of grass grow where only one grew before, is a benefactor to his race. And why? Truly because he thus increases the quantity of food, and enables the world to support a larger population. And is not he who by his skill enables the raw material, whether corn or flesh, furnished to him by the agriculturist, to feed a larger population, or who renders articles alimentary which were formerly rejected, equally a benefactor of his race? Again, every country has its own favourite articles of food, and modes of preparing them; and there is perhaps no subject in regard to which local prejudices are so strong. Now, by bringing these to the test of comparison upon scientific principles, much good would ultimately arise by the gradual introduction into each country of whatever was worthy of imitation in the practice of other nations.

The learned Krunitz, in his voluminous *Economico-Technologic Encyclopedia*, has anticipated many of our views of the subject. "The preparation of good food, and the directions for this purpose contained in cookery books, are commonly very much despised, or rather altogether neglected, by literary men. But in itself cookery does not deserve this contempt, for it is an important part of domestic economy. Upon its due practice depend the health and comfort of families, which must inevitably suf-

fer from errors committed in it. The reason of this contempt is to be found in the manner in which it has hitherto been treated in cookery books, which have been prepared by common cooks, as they are accustomed to dress a ragout. Since the economical arts in general have been discussed scientifically, it is now time that the same attention should be paid to cookery, which is so generally useful, and which is capable of being considered in so many points of view. But then a totally different course from that commonly followed must be pursued. A man of much knowledge, especially physical, chemical, and dietetical, must condescend to apply to the making experiments on vulgar and refined cookery, and collect the whole into a system, as has been done long since in regard to the knowledge and preparation of medicines. What has been written upon dietetics by Zückert, Bergius, Lorry, Plenck, and others, must be compared with the practices in different countries, and a general view of the whole must be drawn up and arranged in systematic order. In regard to the preparations themselves, certain fixed processes and principles are to be determined, general operations to be accurately described, and new improvements to be brought forward. After this the subject might be treated in detail, and a variety, first of simple, then of more compound articles, with the best modes of preparing each as to palatableness, and in relation to effect upon the health, should be perspicuously and thoroughly described. Lastly, their combination into bills of fare, adapted to different ranks in society, modes of life, various tastes, the season of the year, &c. should be pointed out particularly, and with a due regard to good economical arrangements." (2.)

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Difference
Differential.

DIEU ET MON DROIT, *God and my Right*, the motto of the royal arms of England, first assumed by King Richard I. to intimate that he did not hold his empire in vassalage of any mortal. It was afterwards assumed by Edward III. and was continued without interruption to the time of King William, who used the motto *Je maintiendray*, though the former was still retained upon the great seal. After him Queen Anne used the motto *Semper eadem*, which had been before used by Queen Elizabeth; but ever since the time of Queen Anne. *Dieu et mon Droit* continues to be the royal motto.

DIEY, an arrondissement of the department of Vosges, in France, extending over 530 square miles, divided into nine cantons, and containing a population of 83,712 persons, in 109 communes.

DIEY, *St*, a city in the department of the Vosges, in France, the capital of the arrondissement, and situated in a mountainous and woody district on the banks of the Meurthe. It contains 830 houses and 5346 inhabitants. Long. 7. 1. E. Lat. 48. 20. N.

DIEZ, a bailiwick in the duchy of Nassau, in Germany, extending over about 35,000 English acres, and containing a population of 11,487 inhabitants, in two cities and thirty-eight villages. The capital is a city of the same name, situated on the river Lahn, with an industrious population of 2300 persons.

DIFF is the name of an instrument of music among the Arabs, serving chiefly to beat time to the voice; it is a hoop, sometimes with pieces of brass fixed to it to make a jingling, over which a piece of parchment is distended. It is beat with the fingers, and is the true *tympanum* of the ancients.

DIFFARRATION, among the Romans, a ceremony by which the divorce of their priests was solemnized. The word comes from the preposition *dis*, which is used, in

composition, for *division* or *separation*, and *farreatio*, a ceremony with wheat, from *far*, wheat or corn.

Diffarreation was properly the dissolving of marriages contracted by confarreation, which were those of the pontifices or priests. Festus says it was performed with a wheaten cake; but Vigenère maintains that confarreation and diffarreation are the same thing.

DIFFERENCE, in *Mathematics*, is the remainder, when one number or quantity is subtracted from another.

DIFFERENCE, in *Logic*, an essential attribute, belonging to some species, and not found in the genus; being the idea that defines the species. Thus body and spirit are the two species of substance, which in their ideas include something more than is included in the idea of substance. In body, for instance, are found impenetrability and extension; and in spirit, a power of thinking and reasoning; so that the difference of body is impenetrable extension, and the difference of spirit is cogitation.

DIFFERENCE, in *Heraldry*, a term given to a certain figure added to coats of arms, serving to distinguish one family from another, and to show how distant younger branches are from the elder or principal branch.

DIFFERENTIAL, in the higher geometry, an infinitely small quantity, or a particle of quantity so small as to be less than any assignable one. It is called a *differential*, or *differential quantity*, because frequently considered as the difference of two quantities; and, as such, it is the foundation of *differential calculus*. Sir Isaac Newton and the English call it a *moment*, from its being considered as the momentary increase of quantity. See FLUXIONS.

DIFFERENTIAL Equation is an equation involving or containing differential quantities, as the equation $3x^2dx - 2axdx + aydx + axdy = 0$. Some mathematicians have also applied the term differential equation in another sense, to certain equations defining the nature of facts.

Differen-
tial
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Digestion.

DIFFERENTIAL CALCULUS, or *Method*, a method of finding quantities by means of their successive differences. See FLUXIONS.

DIFFORM, *Difformis* (from *dis*, asunder, and *forma*, shape), is a word used in opposition to uniform, and signifies that there is no regularity in the form or appearance of a thing. The botanists use it as a distinction of the flowers of several species of plants.

DIFFUSE, an epithet applied to such writings as are written in a prolix manner. Among historians, Sallust is reckoned sententious, and Livy diffuse. Thus also, among the orators, Demosthenes is close and concise; but Cicero, on the other hand, is diffuse.

DIFFUSION, the dispersion of the subtile effluvia of bodies into a kind of atmosphere all round them. Thus the light diffused by the rays of the sun issues all round from that amazing body of fire.

DIGBY, SIR KENELM, an English philosopher, was born at Gothurst, in Buckinghamshire, in 1603, and became very illustrious for his virtue and learning. He was descended of an ancient family. His great-grandfather, accompanied by six of his brothers, fought valiantly at Bosworth Field on the side of Henry VII. against the usurper Richard III. His father, Sir Everard Digby, was engaged in the gunpowder plot against King James I., and for that crime was beheaded; but his son was restored to his estate. King Charles I. made him gentleman of the bed-chamber, commissioner of the navy, and governor of the Trinity House; and also granted him letters of reprisal against the Venetians, by virtue of which he took several prizes with a small fleet under his command. He fought the Venetians near the port of Scanderoon, and bravely made his way through their ships with his booty. He was a great lover of learning, and translated several authors into English; and his *Treatise of the Nature of Bodies and the Immortality of the Soul* discovers great penetration and extensive knowledge. He applied to chemistry, and found out several useful medicines, which he gave freely away to people of all sorts, especially to the poor. His sympathetic powder for the cure of wounds at a distance made a great noise for a time, but, like other absurd fancies, it soon fell into discredit. He had conferences with Descartes about the nature of the soul.

In the beginning of the civil wars he exerted himself vigorously in the king's cause; but he was afterwards imprisoned by order of the parliament in Winchester House, and had leave to depart thence in 1643. He afterwards compounded for his estate, but was ordered to leave the nation; when he went to France, and was sent on two embassies to Pope Innocent X. from the queen, widow to Charles I., whose chancellor he then was. On the restoration of Charles II. he returned to London, where he died in 1663, at the age of sixty.

This eminent person, on account of his early talents and great proficiency in learning, was compared to the celebrated Pico de Mirandola, and accounted a prodigy of erudition. But his knowledge, though various and extensive, appeared to be greater than it really was, as he had all the powers of elocution and address to recommend it. He knew how to shine in a circle of ladies or philosophers; and was as much attended to when he spoke on the most trivial subjects, as when he conversed on the most important.

DIGEST (*Digestum*), a collection of the Roman laws, arranged and digested under proper titles, by order of the Emperor Justinian. See CIVIL LAW.

DIGESTION, in the animal economy, is the dissolution of the aliments into such minute parts as are fit to enter the lacteal vessels, and to circulate with the mass of blood.

Digestion
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Digging.

DIGESTION, in *Chemistry*, is an operation which consists in exposing bodies to a gentle heat in proper vessels, and during a certain time. This operation is very useful in favouring the action of certain substances upon each other; as, for example, of well calcined, dry, fixed alkali upon rectified spirit of wine. When these two substances are digested together in a matrass, with a gentle sand-bath heat, the spirit of wine acquires a reddish-yellow colour and an alkaline quality. The spirit would not so well acquire these qualities by a stronger and shorter heat.

DIGESTIVE, in *Medicine*, such remedies as strengthen and increase the tone of the stomach, and assist in the digestion of foods.

DIGGES, LEONARD, an eminent mathematician in the sixteenth century, was descended from an ancient family, and born at Digges Court, in the parish of Barham in Kent, but in what year is not known. He was educated at Oxford, where he laid a good foundation of learning; and having retired from thence, he prosecuted his studies, and became an excellent mathematician, a skilful architect, and an expert surveyor of land. He composed several works, as, 1. *Tectonicum*, briefly showing the exact Measuring and speedy Reckoning of all manner of Lands, Squares, Timber, Stones, Steeples, &c. 1556, 4to; 2. A Geometrical Practical Treatise, named *Pantometria*, in three books, which he left in manuscript, but which after his death was published by his son in 1591, folio; 3. *Prognostication Everlasting* of right good effect, or Choice Rules to judge the weather by the Sun, Moon, and Stars, &c. in 4to, 1555, 1556, and 1564; corrected and augmented by his son, with divers general tables, and many compendious rules, in 4to, 1592. He died about the year 1574.

DIGGES, Thomas, only son of Leonard Digges, having received a liberal education from his tenderest years, went and studied for a time at Oxford; and by the improvement which he made there, and the subsequent instructions of his learned father, he became one of the best mathematicians of his age. When Queen Elizabeth sent some forces in order to assist the oppressed inhabitants of the Netherlands, Mr Digges was appointed their muster-master-general; by which he became well skilled in military affairs, as his writings afterwards showed. He died in 1595.

Mr Digges, besides revising, correcting, and enlarging some pieces of his father's already mentioned, wrote and published the following learned works, viz. 1. *Alæ sive Scalæ Mathematicæ*, or Mathematical Wings or Ladders, 1573, 4to; 2. An Arithmetical Military Treatise, containing so much of Arithmetic as is necessary towards military discipline, 1579, 4to; 3. A Geometrical Treatise, named *Stratoticos*, requisite for the perfection of Soldiers, 1579, 4to, which was begun by his father, but finished by himself; 4. A perfect Description of the Celestial Orbs, according to the most ancient doctrine of the Pythagoreans, &c. placed at the end of his father's "Prognostication Everlasting," printed in 1592, 4to; 5. A humble motive for association to maintain the religion established, 1601, 8vo, to which is added, his Letter to the same purpose to the archbishops and bishops of England; 6. England's Defence, or, a Treatise concerning Invasion, a tract of the same nature with that printed at the end of his *Stratoticos*, and called a brief Discourse, &c. but not published till 1686; 7. A Letter printed before Dr John Dee's *Parallaticæ Commentationis praxeosque nucleus quidam*, 1573, 4to. Besides these and his *Nova Corpora*, he left several mathematical treatises ready for the press, which, by reason of law-suits and other avocations, he was prevented from publishing.

DIGGING, among miners, is appropriated to the operation of freeing any kind of ore from the bed or stratum

Digit
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Dignity.

in which it lies, where every stroke of their tools turns to account; in contradistinction to the openings made in search of ore, which are called *hatches*, or *essay-hatches*, and the operation itself, named *tracing of mines*, or *hatching*. When a bed of ore is discovered, the bee-le-men, so called from the instrument they use, which is a kind of pickaxe, free the ore from the fossils around it; and the shovelmén throw it up from one shamble to another, till it reaches the mouth of the hatch. In some mines, to save the expense as well as fatigue of the shovel-men, they raise the ore by means of a winder and two buckets, one of which ascends as the other descends.

DIGIT, in *Astronomy*, the twelfth part of the diameter of the sun and moon, used to express the quantity of an eclipse. Thus an eclipse is said to be of six digits when six of these parts are hid.

DIGITS, or *Monades*, in *Arithmetic*, signify any integer under ten; as, 1, 2, 3, 4, 5, 6, 7, 8, 9, and by means of which all numbers are expressed.

DIGIT is also a measure taken from the breadth of the finger. It is properly three fourths of an inch, and contains the measure of four barleycorns laid breadthwise.

DIGLIGGY NEUR, a town in the island of Ceylon, situated among thick woods and mountains ten or twelve miles to the eastward of Candy, in the direction of Battacolo. When the king was driven out of Candy in 1803 he retreated to this place, to which the European army could not penetrate.

DIGLYPH, in *Architecture*, a kind of imperfect triglyph, console, or the like, with two channels or engravings, either circular or angular.

DIGNE, an arrondissement of the department of the Mouths of the Rhone, in France, 1146 square miles in extent. It is divided into nine cantons and two hundred and sixty communes, containing 49,141 inhabitants. The chief place, of the same name, is situated on the river Bleone, in a neighbourhood covered with fruit gardens, vineyards, and olive woods, the exportation of the products of which forms the chief occupation of the 3487 inhabitants. Long. 5. 58. 59. E. Lat. 44. 5. 18. N.

DIGNITARY, in the canon law, a person who holds a dignity, that is, a benefice which gives him some pre-eminence over mere priests and canons; as a bishop, dean, archdeacon, prebendary, &c.

DIGNITY, as applied to the titles of noblemen, signifies honour and authority. Dignity may be divided into superior and inferior; as the titles of duke, earl, baron, &c. which are the highest names of dignity; and those of baronet, knight, serjeant-at-law, &c. which are the lowest. Nobility only can give so high a name of dignity as to supply the want of a surname in legal proceedings; and as the omission of a name of dignity may be pleaded in abatement of a writ, so it may also be where a peer who has more than one name of dignity is not named by the most noble. No temporal dignity of any foreign nation can give a man a higher title here than that of esquire.

DIGNITY, in the human character, the opposite of meanness.

Man is endowed with a sense of the worth and excellence of his nature. He deems it more perfect than that of the other beings around him; and he perceives that the perfection of his nature consists in virtue, particularly in virtue of the highest rank. To express that sense, the term *dignity* is appropriated. Further, to behave with dignity, and to refrain from all mean actions, is felt to be not only a virtue, but a duty: it is a duty which every man owes to himself. By acting in this manner, he attracts love and esteem; by acting meanly, or below himself, he is discommended and contemned.

This sense of the dignity of human nature reaches even

our pleasures and amusements. If they enlarge the mind by raising grand or elevated emotions, or if they humanize the mind by exercising our sympathy, they are approved as suited to the dignity of our nature; but if they contract the mind by fixing it on trivial objects, they are contemned as not suited to the dignity of our nature. Hence in general every occupation, whether of use or amusement, that corresponds to the dignity of man, is termed manly; and every occupation below his nature is termed childish or puerile.

To those who make a study of human nature, there is a point which has always appeared intricate. How comes it that generosity and courage are more esteemed, and bestow more dignity, than good nature or even justice, though the latter contribute more than the former to private as well as to public happiness? This question, bluntly proposed, might puzzle even a philosopher; but, by means of the foregoing observations, it will be easily solved. Human virtues, like other objects, obtain a rank in our estimation, not from their utility, which is a subject of reflection, but from the direct impression which they make on us. Justice and good nature are a sort of negative virtues, which scarcely make any impression except when they are transgressed. Courage and generosity, on the contrary, producing elevated emotions, enliven the great sense of a man's dignity, both in himself and in others; and for this reason courage and generosity are in higher esteem than the other virtues mentioned; we describe them as grand and elevated, as of greater dignity, and more praiseworthy.

This leads us to examine more directly emotions and passions with respect to the present subject; and it will not be difficult to form a scale of them, beginning with the meanest, and ascending gradually to those of the highest rank and dignity. Pleasure felt as at the organ of sense, in other words, corporeal pleasure, is perceived to be low, and when indulged to excess, is perceived also to be mean; for which reason, persons of any delicacy dissemble the pleasure they take in eating and drinking. The pleasures of the eye and ear having no organic feeling, and being free from any sense of meanness, are indulged without any shame; and they even rise to a certain degree of dignity when their objects are grand or elevated. The case is the same with the sympathetic passions; a virtuous person behaving with fortitude and dignity under cruel misfortunes makes a capital figure, and the sympathizing spectator feels in himself the same dignity. Sympathetic distress, at the same time, is never mean; on the contrary, it is agreeable to the nature of a social being, and excites general approbation. The rank which love possesses in the scale depends in a great measure on its objects. It possesses a low place when founded on external properties merely, and is mean when bestowed on a person of inferior rank, without any extraordinary qualification; but when founded on the more elevated internal properties, it assumes a considerable degree of dignity. The case is the same with friendship. When gratitude is warm it animates the mind; but it scarcely rises to dignity. Joy bestows dignity when it proceeds from an elevated cause.

If we can depend upon induction, dignity is not a property of any disagreeable passion; one is slight, another severe; one depresses the mind, another animates it. But there is no elevation, far less dignity, in any of them. Revenge, in particular, though it inflames and swells the mind, is not accompanied with dignity, not even with elevation. It is not however felt as mean or grovelling, unless when it takes indirect or cowardly measures for gratification. Shame and remorse, though they sink the spirits, are not mean. Pride, a disagreeable passion, bestows no dignity in the eye of a spectator; but vanity always appears mean, and extremely so where founded, as commonly happens, on trivial qualifications.

Dignity.

Dignity. The pleasures of the understanding possess a high rank in point of dignity. Of this every one must be sensible, when he considers the important truths which have been laid open by science; such as general theorems, and the laws which govern the material and moral worlds. The pleasures of the understanding are suited to man as a rational and contemplative being, and they tend not a little to ennoble his nature; even to the Deity he stretches his contemplations, which, in the discovery of infinite power, wisdom, and benevolence, afford delight of the most exalted kind. Hence it appears that the fine arts, studied as a rational pursuit, afford entertainment of great dignity, superior far to what they afford as a subject of taste merely. But contemplation, however in itself valuable, is chiefly respected as subservient to action; for man is intended to be more an active than a contemplative being. He accordingly shows more dignity in action than in contemplation. Generosity, magnanimity, heroism, raise his character to the highest pitch; these best express the dignity of his nature, and advance him nearer to divinity than any other of his attributes.

Having endeavoured to assign the true cause of dignity and meanness, by unfolding the principle on which they are founded, we proceed to explain the final cause of the dignity or meanness bestowed upon the several particulars above mentioned, beginning with corporeal pleasures. These, as far as useful, are, like justice, fenced with sufficient sanctions to prevent their being neglected. Hunger and thirst are painful sensations; and we are incited to animal love by a vigorous propensity. Were corporeal pleasures over and above dignified with a place in a high class, they would infallibly overturn the balance of the mind, by outweighing the social affections. This is a satisfactory final cause for refusing to these pleasures any degree of dignity; and the final cause is not less evident of their meanness when they are indulged to excess. The more refined pleasures of external sense, conveyed by the eye and the ear from natural objects and from the fine arts, deserve a high place in our esteem, because of their singular and extensive utility. In some cases they rise to a considerable dignity; and the very lowest pleasures of the kind are never esteemed mean nor grovelling. The pleasure arising from wit, humour, ridicule, or from what is simply ludicrous, is useful, by relaxing the mind after the fatigue of more manly occupations; but the mind, when it surrenders itself to pleasure of that kind, loses its vigour, and sinks gradually into sloth. The place which this pleasure occupies in point of dignity is adjusted to these views. To make it useful as a relaxation, it is not branded with meanness; to prevent its usurpation, it is removed from that place but a single degree. No man values himself for that pleasure even during gratification; and if it have engrossed more of his time than is requisite for relaxation, he looks back on the circumstance with some degree of shame.

In point of dignity, the social emotions rise above the selfish, and much above those of the eye and ear. Man is by his nature a social being; and to qualify him for society, it is wisely contrived that he should value himself more on being social than selfish. The excellency of man is chiefly discernible in the great improvements he is susceptible of in society. These, by perseverance, may be carried on progressively, beyond any assignable limits; and even abstracting from revelation, there is a very great probability that the progress begun here will be completed in some future state. Now, as all valuable improvements proceed from the exercise of our rational faculties, the Author of our nature, in order to excite us to a due use of these faculties, has assigned a high rank to the pleasures of the understanding. Their utility, with respect

to this life as well as a future one, entitles them to that rank.

But as action is the aim of all our improvements, virtuous actions justly possess the highest of all ranks. These, we find, are by nature distributed into different classes, and the first place in point of dignity is assigned to actions which appear not the first in point of use. Generosity, for example, in the sense of mankind, is more respected than justice, though the latter is undoubtedly more essential to society; and magnanimity, heroism, and undaunted courage, rise still higher in our esteem, for the reason which has been already explained.

DIGNY, a market-town of the department of the Eure and Loire, in France, containing 378 houses and 2160 inhabitants, in the neighbourhood of which are some mines of iron extensively worked.

DIGON, a market-town of the department of the Upper Soane and Loire, in France, with 2508 inhabitants. It is situated near the Loire, at the point where the central canal commences.

DII, the divinities of the ancient inhabitants of the earth, which were very numerous. Every object which caused terror, inspired gratitude, or bestowed affluence, received the tribute of veneration. Man saw a superior agent in the stars, the elements, or the trees; and supposed that the waters which communicated fertility to his fields and possessions were under the influence and direction of some invisible power inclined to favour and to benefit mankind. Thus arose a train of divinities, which imagination arrayed in different forms, and armed with different powers. They were endowed with understanding, and were actuated by the same passions which daily afflict the human race; and those creations of superstition were appeased or provoked in the same manner as the imperfect being who gave them birth. Their wrath was mitigated by sacrifices and incense, and sometimes human victims bled to expiate a crime which superstition alone supposed to exist. The sun, from his powerful influence and animating nature, first attracted the notice and claimed the adoration of the uncivilized inhabitants of the earth. The moon also was honoured with sacrifices and addressed in prayers; and after immortality had been liberally bestowed on all the heavenly bodies, mankind classed amongst their deities the brute creation, and the cat and the sow shared equally with Jupiter himself, the father of gods and men, the devout veneration of their votaries. This immense number of deities has been divided into different classes, according to the will and pleasure of the mythologists. The Romans, generally speaking, reckoned two classes of the gods, the *dii majorum gentium* or *dii consentes*, and the *dii minorum gentium*. The former were twelve in number, namely, six males and six females. (*Vid. CONSENTES.*) In the class of the latter were ranked all the gods who were worshipped in different parts of the earth. Besides these, there were divinities called *dii selecti*, sometimes classed with the twelve greater gods; these were Janus, Saturn, the Genius, the Moon, Pluto, and Bacchus. There were also some called demigods, that is, persons who deserved immortality by the greatness of their exploits, and for their uncommon services to mankind. Amongst these were Priapus, Vertumnus, Hercules, and those whose parents were some of the immortal gods. Besides, all the passions and the moral virtues were reckoned as powerful deities, and temples were raised to a goddess of concord, of peace, and the like. According to Hesiod, there were no less than thirty thousand gods that inhabited the earth, and were guardians of men, all subservient to the power of Jupiter. To these succeeding ages added an almost equal number; and indeed they were so numerous, and their functions so various, that we find temples erected, and sacrifices offered, to

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Dii.

Dijambus unknown gods. It is observable that all the gods of the ancients had lived upon earth as mere mortals; nay even Jupiter, who was the ruler of heaven, is represented by the mythologists as a helpless child; and we are acquainted with all the particulars which attended the birth and education of Juno. In process of time not only good and virtuous men, who had been the patrons of learning and the supporters of liberty, but also thieves and pirates, were admitted amongst the gods; and the Roman senate courteously granted the apotheosis to the most cruel and abandoned of their emperors.

DIJAMBUS, in *Poetry*, the foot of a Latin verse of four syllables. It is compounded of two *iambics*, as *sēvēritās*.

DIJON, an arrondissement of the department of Côte d'Or, in France, which extends over 1190 square miles. It is divided into fourteen cantons and 270 communes, and contains 124,034 inhabitants. The chief place is the city of the same name, the seat of a bishop, and of the several boards which conduct the internal, legal, political, and military affairs of the department. It is situated in a fine plain, watered by the river Ouche, and surrounded on all sides by picturesque hills, inclosing fertile meadows and corn fields. It is a well-built city, with straight and wide streets, and many magnificent buildings, but especially the palace of the ancient sovereigns of Burgundy. There is an academy and public library, and several learned establishments. The houses are 2900, and the inhabitants amounted in 1810 to 21,612; but they have since increased. There are manufactories for cloths, flannels, blankets, cotton goods, hosiery, hats, earthen-ware, vinegar, mustard, and other commodities. Long. 4. 56. 45. E. Lat. 47. 19. 25. N.

DIKE, a ditch or drain, made for the passage of waters. The word seems to have been formed from the verb *to dig*; though others choose to derive it from the Dutch *dijk*, a dam, sea-bank, or wall.

DIKE, or *Dyke*, also denotes a work of stone, timber, or fascines, raised to oppose the entrance or passage of the waters of the sea, a river, lake, or the like. The word comes from the Flemish *dyk*, or *dijk*, a heap of earth to bound or stem the water. Junius and Ménage conceive the Flemish to have borrowed their word from the Greek *ταχος*, *wall*; but Guichard derives it from the Hebrew *daghah*. These dikes are usually elevations of earth, with hurdles of stakes, stones, and other matters.

DILAPIDATION, in *Law*, a wasteful destroying, or letting buildings run to decay, for want of necessary reparation. If the clergy neglect to repair the houses belonging to their benefices, the bishop may sequester the profits thereof for that purpose; and in such cases a prosecution may be brought, either in the spiritual court or at common law, against the incumbent himself, or against his executor or administrator.

DILATATION, in *Physics*, a motion of the parts of any body, by which it is so expanded as to occupy a greater space. This expansive motion depends upon the elastic power of the body; whence it appears that dilatation is different from rarefaction, which is produced by means of heat.

DILEMMA, in *Logic*, an argument equally conclusive by contrary suppositions.

DILLENBURG, a bailiwick in the duchy of Nassau, in Germany, extending over 42,500 English acres, and containing a population of 13,627 persons, in two cities and eighty-two villages. The capital is a city of the same name, situated on the Dille, which is surrounded with walls, and contains 2302 inhabitants.

DILLENIUS, JOHN JAMES, a distinguished botanist of the eighteenth century, who may be called the father of cryptogamic botany, was born at Darmstadt in 1687.

He was educated as a physician in the university of Giessen; but his attention was very early diverted from medical studies to the observation and discrimination of plants; nor does he appear to have ever followed any branch of the practice of physic. In botany he was strictly a practical observer, having addicted himself but little to the principles of classification, and not at all to the physiology of vegetables. Some branches of zoology occasionally engaged him, which an assiduous collector of plants, in their native situations, can hardly escape, so closely are these studies, especially that of insects and the lower tribes of animated beings, connected with botany. Dillenius, whilst at Giessen, wrote several papers for the *Ephemerides Naturæ Curiosorum*, on American plants naturalized in Europe, on coffee, on opium obtained from poppies in Germany, with some minute critical remarks on *Spergula pentandra*, as well as on various cryptogamous plants. He published also a paper on leeches, and two species of *papilio*. He printed at Giessen in 1719 his *Catalogus Plantarum sponte circa Gissam nascentium*, a valuable little octavo volume, with figures drawn and engraved by his own hand, of the parts of fructification, particularly designed to illustrate the generic characters of plants, previously not well arranged or understood. In this work he established many new genera, which have for the most part kept their ground. His great merit as a general botanist consisted in a constant attention to the only sound principle of scientific botany, the discrimination of *genera* by the parts of the flower and fruit. This principle, first proposed by the great Conrad Gesner, Dillenius applied to practice, with a severer judgment and closer attention than perhaps any other person, from Gesner to Linnæus. The little book in question is arranged most inconveniently according to the times of the plants' flowering. Its preface, however, enters into the subject of classification, a subject to which young botanists are generally prone, but of which they as generally, after having embroiled it, take their leave, in proportion as they acquire more practical knowledge. Dillenius so far displayed his judgment, that he rather showed the faults of the systems of Tournefort, Knaut, and Rivinus, than offered any thing of his own. This led him into some controversies, from which he soon disengaged himself, and never subsequently took up the question at all.

The great William Sherard, while returning in 1718 from Smyrna through Germany, met with Dillenius, whose scientific merit could not have escaped so eminent a botanist. He brought him to England in 1721, and excited him to publish, in 1724, that valuable enlarged edition of Ray's *Synopsis* of British plants, which has ever since been in general use, and which the editor enriched with engravings of his own. In this publication, compared with the *Catalogus* of the plants of Giessen above mentioned, we cannot but perceive the difference between an author working upon his own original materials, and the commentator or illustrator of the labours of another. Though Dillenius made numerous and correct additions to Ray's work, in the cryptogamic tribes at least, he rather confused than improved the other parts of the book, especially with regard to synonyms, in which department he was never supremely accurate.

In 1732 Dillenius published his magnificent *Hortus Elthamensis*, in two volumes folio, containing 324 plates, engraved on pewter, with his own hand. Their merit consists in their very great precision and fidelity. The descriptions, and historical as well as botanical remarks, render this a classical book in botany. Its style is good, and the whole performance is worthy of the author, and of his eminent patron, whose brother, Dr James Sherard, was the owner of the garden at Eltham, which furnished the

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rich materials of this publication. Before this book appeared, its author was established at Oxford, in the new professorship founded there by the will of William Sherard, who died in August 1728, and who left L.3000 for the purpose, besides his own library, manuscripts, and ample herbarium. Dillenius took the degree of M.D. in this university in 1735, though he had previously obtained the same rank at Giessen; and he now devoted himself to the completion of the *Pinax*, or universal collection of synonyms, which was Sherard's chief object in this foundation. The work was never finished; for indeed neither Dillenius nor any one else could even at that time be competent to it: still less, as botanists and botanical works multiplied excessively, was this undertaking practicable. The publications of Linnæus soon rendered it unnecessary. That illustrious foreigner in 1736 visited Dillenius, who was desirous of fixing him here as his coadjutor; but to this scheme there were several impediments. Nevertheless these distinguished men continued ever after in correspondence, certainly to the advantage of their common study, except in one but too important instance. We allude to the theory of the fructification of mosses, in which Linnæus implicitly adopted the faulty opinion of the Oxford professor, contrary to his own better observation and judgment, taking the capsule for the anther. This leads us to mention the immortal work on which the fame of Dillenius rests, and which, in its way, will never be excelled, the *Historia Muscorum*, published in 1741, in one quarto volume, with eighty-five plates, drawn and engraved by the author. In this performance, laborious investigation, acute discrimination, supreme accuracy, and profound learning, are displayed beyond all example or comparison. Following inquirers, like the celebrated Hedwig, may, with better helps, have examined the same objects more deeply; but none has taken so complete a view of the subject, nor made so very few mistakes. No botanical book perhaps is so perfect in synonyms. Whether the labour of this undertaking was too much for the health of its author, or whether his sedentary mode of life was, on the whole, injurious, we have no particular information; but he began, soon after the publication of the *Historia Muscorum*, to complain of ill health and advancing age. He was of a short stature and corpulent habit, and died of an apoplexy on the 2d April 1747, in his sixtieth year. A picture of this distinguished botanist is preserved in the picture-gallery at Oxford, from which a print has been published in Sim's and König's *Annals of Botany*, vol. ii. Dillenius is said to have been amiable and respectable in his private character. He never married. His books, collection of mosses referring to his great work, with many drawings, especially of *Fungi*, were bought by his successor Dr Humphrey Sibthorp, and added to the Sherardian Museum, where they still remain. (x. x.)

DILLINGEN, a bailiwick in the circle of Upper Danube, of the kingdom of Bavaria. It extends over seventy square miles, or 44,800 acres, and contains one city, one town, and twenty-two villages, with 10,804 inhabitants. The capital, of the same name, situated on the Danube, contains 550 houses, and 3118 inhabitants, who are chiefly employed in iron-works, but some in making paper.

DILUTE. To dilute a body is to render it liquid, or if liquid before, to render it more so by the addition of a thinner fluid. The fluids thus added are called *diluents*.

DIMACHE (from δις, *double*, and μάχω, *I fight*), in *Antiquity*, a kind of horsemen first instituted by Alexander. Their armour was lighter than that of the infantry, and at the same time heavier than that used by cavalry, so that they could act as horse or foot as occasion required.

DIMENSION, in *Geometry*, is either length, breadth, or thickness. Hence a line has one dimension, or length; a superficies two, or length and breadth; and a body or solid has three, or length, breadth, and thickness. Dimension
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Dimsdale.

DIMINUTION, in *Architecture*, a contraction of the upper part of a column, by which its diameter is made less than that of the lower part.

DIMINUTION, in *Music*, is the abating something of the full value or quantity of any note.

DIMINUTIVE, in *Grammar*, a word formed from some other, to soften or diminish the force of it, or to signify that a thing is little in its kind. Thus, *cellule* is a diminutive of *cell*, *globule* of *globe*, *hillock* of *hill*.

DIMISSORY LETTERS (*Litteræ Dimissoriæ*), in the canon law, a letter given by a bishop to a candidate for holy orders, having a title in his diocese, directed to some other bishop, and giving permission for the ordination of the bearer thereof.

When a person produces letters of ordination or tonsure conferred by any other than his own diocesan, he must at the same time, on pain of nullity, produce the letters dimissory given by his own bishop. Letters dimissory cannot be given by the chapter, *sede vacante*; this being deemed an act of voluntary jurisdiction, which ought to be reserved to the successor.

DIMÆRITÆ, a name given to the Apollinarists, who at first held that the Word only assumed a human body, without taking a reasonable soul; but being at length convinced by formal texts of Scripture, they allowed that he did assume a soul, though without understanding, the Word supplying the want of that faculty. From this way of separating the understanding from the soul, they came to be denominated *dimærites*, that is, *dividers*, *separators*, from δια, and μοιραω, *I divide*.

DIMOTIKA, a city in the Turkish province of Gallipoli, where the rivers Moritza and Kisilnehr join. It contains about 8000 inhabitants, partly Greeks. The chief employment consists in making silk and cotton goods. The citadel served as a residence for the grand signior before the conquest of Constantinople.

DIMSDALE, THOMAS, Baron, greatly distinguished by his practice of inoculation for the small-pox, was the son of a surgeon and apothecary at Theydon-Gernon, in Essex, and was born in the year 1712. His family belonged to the society of Quakers; and his grandfather accompanied William Penn to America, but soon afterwards returned and settled in his native village. Thomas was brought up to his profession, first under his father, and afterwards in St Thomas Hospital, London. He commenced his practice at Hertford about 1734, and married the only daughter of Nathaniel Brassey, of Roxford, near that town, an eminent banker in London, and representative of Hertford in four successive parliaments. But this lady died in 1744, leaving no children. To relieve his mind under the loss of his wife, he voluntarily offered his assistance to the physicians and surgeons in the army under the Duke of Cumberland, and continued with it until after the surrender of Carlisle to the king's forces, when he received the duke's thanks, and returned to Hertford. In 1746 he married Anne Iles, a relation of his first wife, and by her fortune, and that which he had acquired by the death of the widow of Sir John Dimsdale of Hertford, he retired from practice; but his family becoming numerous, and seven of his ten children being living, he resumed it, and took the degree of doctor of medicine in 1761. Having fully satisfied himself concerning the new method of treating persons under inoculation for the small-pox, he published his treatise on this subject in 1776, and it was soon circulated all over the Continent, and translated into all the modern languages, not excepting the Russian. He

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concludes with saying that, "although the whole process may have some share in the success, it, in my opinion, consists chiefly in the method of inoculating with recent fluid matter, and the management of the patients at the time of eruption." This proof of his professional knowledge occasioned his being invited to inoculate the Empress Catherine and her son in 1768, of which he gives a particular account in his Tracts on Inoculation, 1781. His reward for this was an appointment of actual counsellor of state and physician to her imperial majesty, with an annuity of L.500; the rank of a baron of the Russian empire, to be borne by his eldest lawful descendant in succession, and a black wing of the Russian eagle in a gold shield in the middle of his arms, with the customary helmet, adorned with the baron's coronet, over the shield: he also received immediately L.10,000, and L.2000 for travelling charges, besides miniature pictures of the empress and her son, and the same title to his son, to whom the grand duke gave a gold snuff-box, richly set with diamonds. The baron inoculated numbers of people at Moscow; and, resisting the empress's invitation to reside as her physician in Russia, he and his son were admitted to a private audience of Frederick II. king of Prussia, at Sans Souci, and thence returned to England. In 1779 he lost his second wife, who left him seven children. But he afterwards married Elizabeth, daughter of William Dimsdale of Bishops-Stortford, who survived him. He was elected representative of the borough of Hertford in 1780; and declined all practice, except for the relief of the poor. He went to Russia once more in 1781, in order to inoculate the late emperor and his brother Constantine, sons of the grand duke; and as he passed through Brussels, the Emperor Joseph received him in private, and wrote in his presence a letter, which he was to convey to the Empress of Russia. In 1790, his son, Baron Nathaniel, was elected member for the borough of Hertford, on his resignation and retirement to Bath for several winters; but at last he fixed altogether at Hertford, and died, at the age of eighty-nine, on the 30th December 1800, after an illness of about three weeks. About seventeen years before his death he felt the sight of one eye declining, having before lost that of the other, but recovered both by the operation of the cataract, by Wenzel.

DINAGEPORE, a district of Bengal, situated chiefly between the 25th and 26th degrees of N. lat. On the north it is bounded by Rungpoor and Purneah; on the south by Rajeshy; and on the east by Rungpoor, Purneah, and Rajemal. This district possesses a soil much diversified; and the face of the country has a waving appearance, being divided into small valleys, each about two or three miles broad. These valleys are watered by small rivers, which in the rainy season overflow the low lands, and swell into large lakes fifty or sixty miles in length, which, while the Ganges is in flood, have no outlet. They are thus not only prevented from running off, but are so much increased as to be navigable for vessels of considerable burden. After the inundation runs off, these low lands are covered with a luxuriant pasture, on which are fed numerous buffaloes, and large herds of other cattle, or with rich crops of rice, which is the great staple of agriculture; besides tobacco, indigo, and hemp. The land does not answer for wheat or barley. The soil of the elevated portions of the country is in general a stiff clay, in some places black and porous, in others stiff and tenacious. Many sorts of fibrous plants for cordage and sackcloth are sown in April, May, and June; several sorts of pulse are also sown at the commencement of the cold season; and, where the soil is good, the sugar cane is planted in February and March. The inhabitants are in general extremely poor, and their farming utensils are therefore proportionally rude. They are in the pro-

portion of four Hindus to one Mahomedan. The population, according to the best statistical information that could be procured in answer to queries circulated in 1801 by the Marquis Wellesley, then governor-general, amounted to 600,000. The capital, Dinagepore, is situated on an island formed by the Pernabubah river. It is the residence of a rajah, and a place of considerable trade. It is 162 miles north-north-east of Moorshedabad. Long. 89. 40. E. Lat. 25. 37. N.

DINAN, an arrondissement in the department of the Côté du Nord, in France. It extends over 576 square miles, is divided into eight cantons and ninety-two communes, and contains 100,690 inhabitants. The chief place, a city of the same name, strongly fortified, is situated on a hill, at the foot of which the river Rance flows. It is built in an antiquated style, containing 6820 inhabitants, who are employed in making linen from the excellent flax which grows in its vicinity. Long. 2. 8. 25. W. Lat. 48. 27. 16. N.

DINANT, a city, the capital of a circle of the same name, in the province of Namur, in the Netherlands. The circle is divided into six cantons, and contains 92,756 inhabitants. The city is situated on the right bank of the Maas, enclosed by steep hills. It contains 3631 inhabitants, who are occupied with coppersmiths' and ironmongery wares.

DINAPOOR, a town of Hindustan, in the province of Bahar, on the southern bank of the Ganges, two miles west from Patna. Here is a military cantonment belonging to the British, consisting of two handsome squares, built of brick, and capable of containing 1200 European soldiers, and the European officers of the native corps. Long. 85. 3. E. Lat. 25. 38. N.

DINAZZANO, a town of Italy, in the province of Reggio, in the duchy of Modena, situated on the Tessone. It contains 1800 inhabitants.

DINDIGUL, a district in the south of India, situated between the 10th and 11th degrees of N. lat. To the north it has Coimbeetoor and Kistnagherry; to the south Travancore and Madura; on the east the Polygar territory and Madura; and on the west Travancore, Cochin, and Malabar. The principal rivers are the Noil and the Amravati; and the chief towns Dindigul, Balny, and Palapetty. This district was conquered by the Mysore government in 1757. It was taken possession of by the British in 1783, and subsequently restored to Tippoo Sultan. In 1792 it was again ceded to the British, and is now included in the collectorship of Madura. The capital is of the same name; it is a place of considerable consequence, and possesses a strong fortress, situated on a rock. Long. 78. 5. E. Lat. 10. 22. N.

DINDING, a small island in the Straits of Malacca, at the entrance of the river Pera, about twenty miles in circumference. Long. 100. 36. E. Lat. 4. 15. N.

DINGWALL, a royal burgh of Scotland, and capital of the county of Ross. It lies in a low situation at the mouth of a glen opening into the north side of the Cromarty Frith, near the western extremity of that estuary. The town is rather neatly built, and consists of one main street, from which several smaller ones branch off. The town-house is a curious old building, and stands in the centre of the place. The church is a plain edifice, on the north side of the town, with an obelisk in its neighbourhood, fifty-seven feet in height, erected to the memory of the first Earl of Cromarty, who was buried here. This place possesses a small harbour, near which formerly stood the mansion of the powerful family of Ross; but of this princely structure only a few fragments remain. Dingwall was created a royal burgh by Alexander II.; and its charter was renewed by James IV. Its civic governors are a

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provost, two bailies, a dean of guild, treasurer, and ten counsellors. There is a weekly market held on Friday, and two yearly fairs. It is distant 178 miles north-west from Edinburgh. The population of the town and parish amounted in 1821 to 2031, and in 1831 to 2124.

DINKELSBUHL, a city of the kingdom of Bavaria, in the circle of Rezat, the chief place of a bailiwick. It is situated on the river Wernitz, is fortified, and contains 900 houses, and 6450 inhabitants, who carry on manufactures of woollen cloth, hats, stockings, and leather. The bailiwick, of the same name, extends over 902 square miles, or 577,280 English acres, and contains 10,350 inhabitants.

DINNER, the principal meal of the day. The word is derived from the French *disner*, which Du Cange derives from the barbarous Latin *disnare*; but Henry Stephens derives it from the Greek *δειπναι*, and contends that it should be written *dipner*. Ménage deduces it from the Italian *desinare*, to dine; and that from the Latin *desinere*, to leave off work.

DINOCRATES, a celebrated architect of Macedonia, who rebuilt the temple of Ephesus, when burnt by Erostratus, with much more magnificence than before. Vitruvius informs us that Dinocrates proposed to Alexander the Great to convert Mount Athos into the figure of a man, whose left hand should contain a walled city, whilst all the rivers of the mount should flow into his right, and thence into the sea. He also conceived a scheme for building the dome of the temple of Arsinoë at Alexandria of loadstone, that by its attraction it should hold her iron image in the centre, suspended in the air; projects which at least showed great boldness and conception.

DINSLAKEN, a circle in the Prussian province of Westphalia, a part of the ancient duchy of Cleves. It extends over 201 square miles, or 128,640 English acres, and comprehends five cities, one town, and thirty-one villages, with 26,876 inhabitants. The chief place is a town of the same name, situated on the Misine, and containing 1063 inhabitants.

DIO CHRYSOSTOM, that is, *Golden Mouth*, a celebrated orator and philosopher of Greece, in the first century, was born at Prusa in Bithynia. He attempted to persuade Vespasian to renounce the empire; and he was hated by Domitian, but acquired the esteem of Trajan. This last prince took pleasure in conversing with him, and made Dio ride with him in his triumphal chariot. There are still extant eighty of his orations, and some other of his works; the best edition of which is that of Hermand Samuel Raimarus, in 1750, folio.

DIOCESE, or **DIOCESS**, the circuit or extent of the jurisdiction of a bishop. The word is formed from the Greek *διοικησις*, government, administration, derived from *διοικω*, which the ancient glossaries render *administro*, *moderor*, *ordino*; and hence *διοικησις της πολιως*, the administration or government of a city.

DIOCESE is also used in ancient authors for the province of a metropolitan.

Diocæsis (*διοικησις*) was originally a civil government, or prefecture, composed of different provinces.

The first division of the empire into dioceses is ordinarily ascribed to Constantine, who distributed the whole Roman world into four, namely, the diocese of Italy, the diocese of Illyria, that of the East, and that of Africa. And yet long before the time of Constantine, Strabo, who wrote under Tiberius, takes notice (lib. xiii. p. 432), that the Romans had divided Asia into dioceses; and he complains of the confusion which such a division occasioned in geography, Asia being no longer divided by people, but by dioceses, each of which had a tribunal or court, where justice was administered. Constantine, therefore, was only the institutor of those large dioceses, which comprehend-

ed several metropolises and governments; the former dioceses only comprehending one jurisdiction or district, or the country which had resort to one judge, as appears from the above passage in Strabo, and also from two in Cicero (lib. iii. *epist. ad Famil.* 9, and lib. xiii. *ep.* 67).

Thus at first a province included different dioceses, and afterwards a diocese came to comprehend different provinces. In after times the Roman empire became divided into thirteen dioceses or prefectures; though, including Rome and the suburbic regions, there were fourteen. These fourteen dioceses comprehended a hundred and twenty provinces; each province had a proconsul, who resided in the capital or metropolis; and each diocese of the empire had a consul, who presided in the principal city of the district.

On this civil constitution the ecclesiastical one was afterwards regulated; and each diocese had an ecclesiastical vicar or primate, who judged finally of all the concerns of the church within his territory. At present, however, diocese does not signify an assemblage of different provinces, but is limited to a single province under a metropolitan, or more commonly to the single jurisdiction of a bishop.

Brito affirms that diocese is properly the territory and extent of a baptismal or parochial church; and hence various authors use the word to signify a simple parish. See **PARISH**.

DIOCLEIA (*Διοκλεία*), in *Antiquity*, a solemnity observed during spring at Megara, in memory of the Athenian hero, who died in defence of the youth he loved.

DIOCLETIANUS, **CAIUS VALERIUS JOVIUS**, a celebrated Roman emperor, born of an obscure family in Dalmatia in the year 245. Although originally a common soldier, yet by merit and success he gradually rose to the rank of general; and at the death of Numerian in 284 he was invested with the imperial purple. In this high station he rewarded the virtues and fidelity of Maximian, who had shared with him all the subordinate offices in the army, by making him his colleague on the throne. He created two subordinate emperors, Constantius and Galerius, whom he called Cæsars, whilst he claimed for himself and his colleague the superior title of Augustus. Diocletian has been celebrated for his military virtues; and although he was naturally unpolished by education and study, yet he was the friend and patron of learning and true genius. He was bold and resolute, active and diligent, and well acquainted with the arts, which endear a sovereign to his people, and make him respectable even in the eyes of his enemies. His cruelty, however, against the followers of Christianity, has been deservedly branded with infamy. After he had reigned twenty-two years in the greatest prosperity, he publicly abdicated the crown at Nicomedia in 305, and retired to a private station at Salona. Maximian his colleague followed his example, but not from choice; and when he some time afterwards endeavoured to rouse the ambition of Diocletian, and to persuade him to re-assume the purple, he received for answer, that Diocletian took now more delight in cultivating his little garden than he had formerly enjoyed in a palace, when his power extended over all the Roman world. He lived nine years after his abdication, in the greatest security and enjoyment, at Salona, and died in 314, in the sixty-eighth year of his age. Diocletian is the first sovereign who voluntarily resigned his power. His bloody persecution of the Christians forms a chronological era, called the *era of Diocletian*, or of the martyrs. It was for a long time in use in theological writings, and is still preserved by the Copts and Abyssinians. It commenced on the 29th August 284.

DIODATI, **JOHN**, a famous minister, and professor of theology at Geneva, was born at Lucca in 1579, and died

Diodorus at Geneva in 1652. He is distinguished by translations,
 || 1. Of the Bible into Italian, with notes, Geneva, 1607, 4to.
 Diogenes. The best edition is that of Geneva in 1641, folio. This is
 said to be more a paraphrase than a translation, and the
 notes are rather divine meditations than critical reflections.
 2. Of the Bible into French, Geneva, 1644; 3. Of Father
 Paul's History of the Council of Trent into French.

DIODORUS, an historian, surnamed *Siculus*, because
 he was born at Argyra, in Sicily. He wrote a history of
 Egypt, Persia, Syria, Media, Greece, Rome, and Carthage;
 and it is said that he visited all the places of which
 he has made mention in his history, which occupied the
 labour of thirty years. He is, however, too credulous in
 some of his narrations, and frequently wanders far from
 the truth. He often dwells too long upon fabulous reports
 and trifling incidents; whilst events of the greatest importance
 to history are treated with brevity, and sometimes
 passed over in silence. He lived in the age of Julius Cæsar
 and Augustus; and spent much time at Rome in order to
 procure information, and authenticate his historical narrations.
 This important work, which he composed in Greek,
 contained forty books, of which there are only fifteen remaining.
 The style is clear and neat, and very suitable
 to history. The best edition is that of Wesseling, Amsterdam,
 1745, in 2 vols. folio, with very learned and judicious
 remarks. It has been reprinted with important additions
 by the society of Deux-Ponts, 1793-1801, in 11 vols. 8vo.
 The Latin translation of Poggio, Bologna, 1742, folio, is
 very incomplete, and only sought after by reason of its
 scarcity. Diodorus Siculus has been translated into French
 by Terrasson, Paris, 1737, in 7 vols. 12mo.

DIOGENES of Apollonia, in the island of Crete, held
 a considerable rank among the philosophers who taught in
 Ionia before Socrates appeared at Athens. He was the
 scholar and successor of Anaximenes, and in some measure
 rectified his master's opinion concerning air being
 the cause of all things. It is said that he was the first
 who observed that air was capable of condensation and
 rarefaction. He passed for an excellent philosopher, and
 died about the 450th year before the Christian era.

DIOGENES the Cynic, a famous philosopher, was the son
 of a banker of Sinope, in Pontus. Being banished with his
 father for coining false money, he retired to Athens, where
 he studied philosophy under Antisthenes. He added new
 austerity to the sect of the Cynics, and never did any philosopher
 carry so far a contempt for the conveniences of
 life. He was one of those men who push every thing to
 excess, without excepting even reason itself; and who confirm
 the saying, that there is no great genius without a tincture
 of madness. He lodged in a tub; and had no other
 moveables besides his staff, wallet, and wooden bowl, which
 last he threw away on seeing a boy drink out of the hollow
 of his hand. He used to call himself a vagabond, who had
 neither house, home, nor country; he was obliged to beg,
 was ill clothed, and lived from hand to mouth, and yet, says
 Ælian, he took as much pride in these things as Alexander
 could in the conquest of the world. He was not indeed a
 jot more humble than those who are clothed in rich apparel,
 and fare sumptuously every day. He looked down on all
 the rest of the world with scorn; he magisterially censured
 all mankind, and thought himself unquestionably superior
 to all other philosophers. Alexander one day paid him a
 visit, and made him an offer of riches, or any thing else;
 but all that the philosopher requested of him was, to stand
 from betwixt him and the sun. The conqueror was so
 affected with the vigour and elevation of his soul, as to
 declare that, "if he were not Alexander, he would choose
 to be Diogenes;" that is, if he were not in possession of
 all that was pompous and splendid in life, he would, like
 Diogenes, heroically despise it. Diogenes had great presence

of mind, as appears from his sharp sayings and quick repartees;
 and Plato seems to have hit off his true character when he
 called him a Socrates run mad. He spent a great part of his
 life at Corinth. The reason of his living there was curious
 and characteristic. As he was going over to the island
 Ægina, he was taken by pirates, who carried him into Crete,
 and there exposed him to sale. He answered the crier, who
 asked him what he could do, that "he knew how to command
 men;" and perceiving a Corinthian who was passing by,
 he showed him to the crier, and said, "Sell me to that
 gentleman, for he wants a master." Xenias, for that was
 the Corinthian's name, bought Diogenes, and carried him to
 Corinth, where he appointed him tutor to his children, and
 intrusted him also with the management of his house.
 Diogenes's friends being desirous to redeem him, "You are
 fools," said he; "the lions are not the slaves of those who
 feed them, but they are the servants of the lions." He
 therefore plainly told Xenias that he ought to obey him, as
 people obey their governors and physicians. Some say that
 Diogenes spent the remainder of his life in Xenias's family;
 but Dion Chrysostom asserts that he passed the winter at
 Athens and the summer at Corinth. He died at Corinth when
 he was about ninety years old; but authors are not agreed
 either as to the time or the manner of his death. The
 following account, Jerome says, is the true one. As he was
 going to the Olympic games, a fever seized him by the way;
 upon which he lay down under a tree, and refused the
 assistance of those who accompanied him, and who offered
 him either a horse or a chariot. "Go you to the games,"
 said he, "and leave me to contend with my illness. If I
 conquer, I will follow you; if I am conquered, I shall go to
 the shades below." He dispatched himself that very night;
 saying, that "he did not so properly die, as get rid of his
 fever." He had for his disciples Onesicritus, Phocion,
 Stilpo of Megara, and several other great men. His
 works are lost.

DIOGENES Laertius, so called from Laertia, in Cilicia,
 where he was born, an ancient Greek author, who wrote
 ten books of the Lives of the Philosophers, still extant.
 In what year he flourished it is not easy to determine.
 The oldest writers who mention him are Sopater Alexandrinus,
 who lived in the time of Constantine the Great, and
 Hesychius Milesius, who lived under Justinian. Diogenes
 often speaks in terms of approbation of Plutarch and
 Phavorinus; and therefore, as Plutarch lived under Trajan,
 and Phavorinus under Hadrian, it is certain that he could
 not flourish before the reigns of those emperors. Ménage
 has fixed him as contemporary with Severus, that is, about
 the year of Christ 200. From certain expressions of his,
 some have fancied him to have been a Christian; but, as
 Ménage observes, the immoderate praises he bestows upon
 Epicurus will not permit us to believe this, but must incline
 us rather to suppose that he was an Epicurean. He divided
 his Lives into books, and inscribed them to a learned lady
 of the Platonic school, as he himself intimates in his life
 of Plato. Montaigne was so fond of this author, that,
 instead of one Laertius, he wishes we had a dozen; and
 Vossius says that his work is as precious as gold. Without
 doubt, we are greatly obliged to him for what we know of
 the ancient philosophers; and if he had been as exact in
 writing as he was judicious in the choice of his subject,
 we should have been still more obliged to him. Bishop
 Burnet, in the preface to his life of Sir Matthew Hale,
 speaks of him in the following proper manner; "There is
 no book the ancients have left us, which might have
 informed us more than Diogenes Laertius's Lives of the
 Philosophers, if he had had the art of writing equal to that
 great subject which he undertook; for if he had given the
 world such an account of them as

Diogenes.

Diomedes
||
Dion.

Gassendus has done of Peiresc, how great a stock of knowledge might we have had, which by his unskilfulness is in a great measure lost, since we must now depend only on him, because we have no other and better author who has written on that subject." There have been several editions of his *Lives of the Philosophers*; but the best is that printed in two volumes 4to, at Amsterdam, 1693. This contains the advantages of all the former, besides some which are peculiar to itself; such as the Greek text and the Latin version corrected and amended by Meibomius; the entire notes of Henry Stephens, of both the Casaubons, and of Ménage; and twenty-four copperplates of philosophers, elegantly engraved; to which is added, *The History of the Female Philosophers*, written by Ménage, and dedicated to Madame Dacier. Besides this, Laertius wrote a book of Epigrams upon illustrious Men, called *Pammetrus*, from its various kinds of metre; but this is not now extant.

DIOMEDES, son of Tydeus and Diophyle, was king of Ætolia, and one of the bravest of the Grecian chiefs in the Trojan war. He often engaged Hector and Æneas, and obtained much military glory. He went with Ulysses to steal the Palladium from the temple of Minerva in Troy; and assisted in murdering Rhesus, king of Thrace, and in carrying away his horses. On his return from the siege of Troy he lost his way in the darkness of night, and landed in Attica, where his companions plundered the country, and lost the Trojan Palladium. During his long absence, his wife Ægiale forgot her marriage vows, and prostituted herself to Cometes, one of her servants. This lasciviousness of the queen was attributed by some to the resentment of Venus, whom Diomedes had severely wounded in a battle before Troy. The infidelity of Ægiale proved highly displeasing to Diomedes. He resolved to abandon his native country, which was the seat of his disgrace; and the attempts of his wife to take away his life contributed, according to some accounts, to hasten his departure. He proceeded to that part of Italy afterwards named Magna Græcia, where he built a city, which he called Argyrippa, and married the daughter of Daunus, the king of the country; and he died there in extreme old age, or, according to a certain tradition, he perished by the hand of his father-in-law. His death was greatly lamented by his companions, who in the excess of their grief were changed into birds resembling swans, which took flight into a neighbouring island in the Adriatic, and became remarkable no less for the tameness with which they approached the Greeks, than for the horror with which they shunned all other nations. They were called the birds of Diomed. Altars were raised to Diomedes as to a god, one of which Strabo mentions at Timavus.

DION, a Syracusan, son of Hipparinus, famous for his power and abilities. He was related to Dionysius, and often, along with the philosopher Plato, who had come to reside at the tyrant's court, advised him to lay aside the supreme power. But his great popularity rendered him odious in the eyes of the tyrant, who banished him to Greece. There, however, he collected a numerous force, and resolved to free his country from tyranny; an achievement which he easily effected, on account of his uncommon popularity. He entered the port of Syracuse with only two ships, and in three days reduced under his power an empire which had already subsisted for fifty years, and which was guarded by five hundred ships of war, and above a hundred thousand troops. The tyrant fled to Corinth, and Dion kept the power in his own hands, fearful of the aspiring ambition of some of the friends of Dionysius; but he was shamefully betrayed and murdered by one of his familiar friends, called Callicrates or Callipus, 354 years before the Christian era.

DION Cassius, a native of Nicæa, in Bithynia, whose father's name was Apronianus. He was raised to the greatest offices of state in the Roman empire by Pertinax and his three successors. Being naturally fond of study, he improved himself by unwearied application, and spent ten years in collecting materials for a history of Rome, which he published in eighty books, after a laborious employment of twelve years in composing it. This valuable history commenced with the arrival of Æneas in Italy, and extended to the reign of the Emperor Alexander Severus. The first thirty-four books are totally lost; the twenty following, that is, from the thirty-fifth to the fifty-fourth, remain entire; the six following are mutilated; and fragments are all that we possess of the last twenty. In the compilation of this extensive history, Dion proposed to himself Thucydides as a model, but he is not perfectly happy in his imitation. His style is pure and elegant, his narrations are judiciously managed, and his reflections are generally learned; but, upon the whole, he is credulous, and the bigoted slave of partiality, satire, and flattery. He inveighs against the republican principles of Brutus and Cicero, and extols the cause of Cæsar. Seneca is the object of his satire, and is represented by the historian as debauched and licentious in his morals.

DIONIS, PETER, born at Paris, was one of the greatest surgeons of the eighteenth century. In the time of Louis XIV. he was appointed anatomical and chirurgical demonstrator in the Garden of Plants, and he was the first who held that place. He was surgeon in ordinary to Maria Theresa of Austria, queen of France, and to two dauphinesses and the royal children. He was the author of several works, both on anatomical and surgical subjects. One of the first of his publications is entitled *Anatomie de l'Homme, suivant la circulation du sang, et les nouvelles découvertes*, 8vo, which appeared in 1690, and has been frequently reprinted, and translated into different languages. It was translated into the Tartar dialect, by a Jesuit, for the use of Kang-hi, emperor of China. This work has been considered as a useful compendium of anatomy. In another work which he published in 1698, entitled *Dissertation Historique et Physique sur la Génération de l'Homme*, he supports the ovarian hypothesis. In 1707 he published a work on surgery, entitled *Cours d'Opérations de Chirurgie*, 8vo, which was several times reprinted; and latterly it was edited with notes by Lafaye, in two vols. This treatise was long received as a standard book on the subject. It contains many useful and pertinent observations, detailed in plain, unaffected language. Dionis is the author of two other works; the first, *Dissertation sur la Mort Subite*, 12mo, published in 1709, and the other *Traité Générale des Accouchements* in 1718, 8vo. But the last is little else than an abridgment of Mauriceau's work on the same subject. Dionis died at Paris on the 11th December 1718.

DIONYSIA, in Grecian antiquity, solemnities in honour of Bacchus, sometimes called by the general name of *Orgia*, and by the Romans *Bacchanalia* and *Liberalia*.

DIONYSIACA, in *Antiquity*, was a designation given to plays and all manner of sports acted on the stage; because playhouses were dedicated to Dionysius or Bacchus, and Venus, as being the deities of sports and pleasure.

DIONYSIUS I. from a private secretary became general and tyrant of Syracuse and all Sicily. He was likewise a poet; and having, by bribes, gained the tragic prize at Athens, he indulged himself so immoderately at table from excess of joy, that he died of the debauch, 368 B. C.; but some authors assert that he was poisoned by his physicians.

DIONYSIUS II. his son and successor, was a greater tyrant than his father. His subjects were obliged to apply

Dion
Cassius
||
Dionysius.

Dionysius to the Corinthians for succour; and Timoleon, their general, having conquered the tyrant, forced him to flee to Corinth, where, it is said, he was obliged to keep a school for his subsistence. He died 343 B. C.

DIONYSIUS *Halicarnassensis*, a celebrated historian, and one of the most judicious critics of antiquity, was born at Halicarnassus. After the battle of Actium he went to Rome, where he staid twenty-two years under the reign of Augustus, and there composed in Greek his History of the Roman Antiquities, in twenty books, of which the first eleven only are now remaining. There are also still extant several of his critical works. The best edition of the works of this author is that of Dr Hudson, Oxford, 1704, in Greek and Latin, 2 vols folio. It has been reprinted more correctly, with notes by Reiske, Leipzig, 1774-1777, in six vols. 8vo.

DIONYSIUS, a learned geographer, to whom is attributed a *Periegesis*, or Survey of the Earth, in Greek verse. Some suppose that he lived in the time of Augustus; but Scaliger and Salmasius place him under the reign of Severus, or of Marcus Aurelius. He wrote many other works, but his *Periegesis* is the only one we have remaining, the best and most useful edition of which is that improved with notes and illustrations by Hill.

DIONYSIUS *Areopagita* was born at Athens, and educated there. He went afterwards to Heliopolis, in Egypt, where, if we may credit some writers of his life, he beheld that wonderful eclipse which happened at our Saviour's passion, and was urged by some extraordinary impulse to cry out, *Aut Deus patitur, aut cum patiente dolet*, either God himself suffers, or sympathises with him who does. At his return to Athens he was elected into the court of Areopagus, from which circumstance he derived his name of *Areopagite*. About the year 50 he embraced Christianity; and, as some say, was appointed first bishop of Athens by St Paul. Of his conversion we have an account in the 17th chapter of the Acts of the Apostles. He is supposed to have suffered martyrdom, but whether under Domitian, Trajan, or Hadrian, is not certain. We have nothing remaining under his name except what there is every reason to believe spurious.

DIONYSIUS *the Lesser*, a Scythian, who became abbot of a monastery at Rome. He was the first who computed time from the birth of Dionysius to Christ, and fixed that great event according to the vulgar era. He was also a learned canon law writer, and died about the year 540.

DIOPHANTINE PROBLEMS, in *Mathematics*, certain questions relating to square and cube numbers, and right-angled triangles, the nature of which was determined by Diophantus, a mathematician of Alexandria, who is believed to have lived about the third century. The works of Diophantus were published with notes at Paris in 1621, by Bachet de Meziriac; and another edition appeared in 1670, with observations on every question by M. Fermat.

DIOPHANTUS, a celebrated mathematician of Alexandria, reputed to be the inventor of algebra. It is not certain when Diophantus lived; some have placed him before Christ, and some after, in the reigns of Nero and the Antonines, but all with equal uncertainty. It seems he is the same Diophantus who wrote the *Canon Astronomicus*, which, Suidas says, was commented on by the celebrated Hypatia, daughter of Theon of Alexandria. His reputation must have been very high among the ancients, since they ranked him with Pythagoras and Euclid in mathematical learning. Bachet, in his notes upon the fifth book *De Arithmetica*, has collected, from Diophantus's epitaph in the Anthologia, the following circumstances of his life, namely, that he was married when he was thirty-three years old, and had a son born five years thereafter; that this son died when he was forty-two years of age, and that

his father did not survive him above four years. From this it appears that Diophantus was eighty-four years old when he died.

DIOPTASE of *Haüy*; the rhombohedral emerald malachite of *Mohs*. This is a very rare mineral; it occurs in crystals of small dimensions, of a brilliant emerald green colour, disposed in limestone, and is only found in the Kirghese steppes, Siberia. See MINERALOGY, *Index*.

DIOPTRER, or DIOPTRA, the same with the index or alidade of an astrolabe, or other such instrument.

DIOPTRA was an instrument invented by Hipparchus, which served several purposes, as to level water courses, to take the height of towers or places at a distance, to determine the places, magnitudes, and distances of the planets, and the like.

DIOPTRICS, that part of optics which treats of the laws of refraction, and the effects which the refraction of light has in vision. See OPTICS.

DIOSCORIDES, a physician of Cilicia, who lived, as some suppose, in the age of Nero. He was originally a soldier, but afterwards applied himself to study, and wrote a book upon medicinal herbs.

DIOSCURIA (*διοσκουρία*, from *Διος*, Jupiter, and *κουροι*, infants), in *Antiquity*, a festival in honour of the *Διοσκουροι*, or Castor and Pollux, who were reputed to be the sons of Jupiter. It was observed by the Cyreneans, but especially by the Spartans, whose country was believed to have been honoured by the birth of these heroes. The solemnity was full of mirth, being a time in which they shared plentifully of the gifts of Bacchus, and diverted themselves with sports, of which wrestling matches always formed a part.

DIOSZEG, a market-town of Hungary, in the province of Farther Theis, in the circle Grosswardein. It contains a reformed and a Greek church, and 3500 inhabitants, who are chiefly employed in the cultivation of vines and of tobacco. Long. 21. 54. 5. E. Lat. 47. 31. 40. N.

DIPHTHONG, in *Grammar*, a double vowel, or the mixture of two vowels pronounced together so as to make one syllable.

The Latins pronounced the two vowels in their diphthong *ae* or *æ*, and *oe* or *œ*, much as we do, only that the one was heard much weaker than the other, though the division was made with all the delicacy imaginable. Diphthongs with reference to sight, are distinguished from those with reference to sound. In the former, either the particular sound of each vowel is heard in the pronunciation; or the sound of one of them is drowned; or, lastly, a new sound, different from either, results from both; but the first of these only are real diphthongs, as being such both to the eye and ear. Diphthongs with regard to the ear are either formed of two vowels meeting in the same syllable, or of two vowels whose sounds are severally heard; or of three vowels in the same syllable, which only afford two sounds in the pronunciation.

English diphthongs, with regard to the eye and ear, are *ai*, *au*, *ea*, *ee*, *ei*, *oo*, *ou*. Improper English diphthongs, with regard to the eye only, are *aa*, *ae*, *eo*, *eu*, *ie*, *ei*, *œ*, *ue*, *ui*.

DIPLOMA, in a peculiar sense, is used for an instrument or license given by colleges, societies, and such like bodies, to a clergyman to exercise the ministerial function, or to a physician to practise the profession, after passing examination, or admitting him to a degree.

DIPLOMATICS, the science of diplomas, or of ancient literary monuments, public documents, and the like. It does not, however, nor can it, absolutely extend its researches to antiquity, but is chiefly confined to the middle age and the first centuries of modern times. For although the ancients were accustomed to reduce their contracts

Diopase
Diplomatics.

Diploma-
tics.

and treaties into writing, yet they engraved them on tablets of brass, copper, stone, or wood; and all that in the first ages were not traced on brass or marble has perished by the length of time and the number of destructive events.

1. The word *diploma* signifies properly a letter or epistle which is folded in the middle, and which consequently is not open. But in more modern times the title has been given to all ancient epistles, letters, literary monuments, and public documents, and to all those pieces of writing which the ancients called *Syngrapha*, *Chirographa*, *Codicilli*, and the like. In the middle ages, and in the diplomas themselves, these writings are called *Litteræ*, *Præcepta*, *Placita*, *Chartæ indiculæ*, *Sigilla*, and *Bullæ*; as also *Panchartæ*, *Pantochartæ*, *Tractoriæ*, *Descriptiones*, and so forth. The originals of these pieces are named *Exemplaria* or *Autographa*, *Chartæ authenticæ*, *Originalia*, &c. and the copies, *Apographa*, *Copiæ*, *Particulæ*, and so on. The collections which have been made of them are called *Chartaria* and *Chartulia*. The place where these papers and documents were kept the ancients named *Serinia*, *Tabularium*, or *Ærarium*, words which were derived from the tablets of brass, and, according to the Greek idiom, *Archeium* or *Archivum*.

2. In order to understand the nature of these ancient papers, diplomas, and manuscripts, and to distinguish the authentic from the counterfeit, it is necessary to know that the paper of the ancients came from Egypt, and was formed of thin leaves or membranes taken from the branches of a tree named *Papyrus Biblum*, or *Ægyptiacum*, and which were pasted one over the other with the slime of the Nile, and pressed and polished with a pumice stone. This paper was very scarce, and it was of various qualities, forms, and prices, which they distinguished by the name of *charta hieratica*, *luria*, *augusta*, *amphitheatrica*, *saitica*, *tanirica*, *emporetica*. They cut this paper into square leaves, which they pasted one to the other in order to make rolls of them, whence an entire book was called *volumen*, from *volvere*, to roll, and the leaves of which it consisted *pagina*. Sometimes, also, they pasted the leaves all together by one of their extremities, as is now practised in binding; by this method they formed the back of a book, and these the learned called *codices*. They rolled the volume round a stick, which they named *umbilicus*, and the two ends which protruded beyond the paper were called *cornua*. The title, written on parchment in purple characters, was joined to the last sheet, and served it as a cover. They made use of all sorts of strings or ribands, and even sometimes of locks, to close the book; and sometimes also it was put into a case. But there is not now to be found, in any library or cabinet whatsoever, any one of these volumes. We have been assured, however, by a traveller, that he had seen several of them in the ruins of Herculaneum, but so damaged, and the paper so stiff and brittle, by length of time, that it was impossible to unroll them, and, consequently, to make use of any of them; for on the first touch they fell into tatters.

3. We are ignorant of the precise time when our modern paper was invented, and when people began to make use of pens in writing instead of the stalks of reeds. The ink which the ancients used was not made of vitriol and galls, like the modern, but of soot. Sometimes also they wrote with red ink made of vermilion, or in letters of gold on purple or violet parchment. It is not difficult for those who apply themselves to this study, to distinguish the parchment of the ancients from that of the moderns, as well as the ink; but that which best distinguishes the original from the counterfeit is the writing or character itself, which is so different in different centuries, that we may

tell with certainty, within about forty or fifty years, when any diploma was written. There are two works which furnish the clearest lights on this matter, and which may serve as sure guides in the judgments we may have occasion to form as to what are called *ancient diplomas*. The one is the celebrated treatise on Diplomatics, by Mabilon, and the other the first volume of the *Chronicon Gotvicense*. We there find specimens of all the characters, the flourishes, and different methods of writing, of every age. For these matters, therefore, we must refer our readers to the works just mentioned.

4. All the diplomas are written in Latin, and consequently the letters and characters have a resemblance to each other; but there are certain strokes of the pen which distinguish not only the ages, but also the different nations, as the writings of the Lombards, French, Saxons, and so on. The letters in the diplomas also are usually longer and less decided than those of manuscripts. There has also been introduced a kind of court hand, of a very disproportionate length, and the letters of which are called *exiles litteræ crispæ, ac protractiores*. The first line of the diploma, the signature of the sovereign, that of the chancellor, notary, &c. are usually written in this character.

5. The signature of a diploma consists either of the sign of the cross, or of a monogram or cipher, composed of the letters of the names of those who subscribed it. The initial letters of the name, and sometimes also the titles, were placed about this cross. By degrees the custom changed, and they invented other marks, as, for example, the sign of Charlemagne, which was thus written:

$$\begin{array}{c} R \\ K - \frac{A}{V} - S \\ L \end{array}$$

They sometimes also added the dates and epoch of the signature, the feasts of the church, the days of the calendar, and other like matters. The successive corruption of the Latin language; the style and orthography of each age, as well as their different titles and forms; the abbreviations, accentuation, and punctuation, and the various methods of writing the diphthongs; all these matters united form so many characters and marks by which the authenticity of a diploma may be known.

6. The seal annexed to a diploma was anciently of white wax, and was artfully imprinted on the parchment itself. It was afterwards pendant from the paper, and inclosed in a box or case, which was called *bulia*. There are also some which have been stamped on metal, and even on pure gold. When a diploma bears all the characters which are requisite to the time and place where it is supposed to be written, its authenticity is not to be doubted; but at the same time we cannot examine these too scrupulously, seeing that the monks and priests of former ages were very adroit in making counterfeits, the more so as they enjoyed the confidence of princes and statesmen, and were even sometimes in possession of their rings or seals.

7. With regard to manuscripts which were written before the invention of printing, it is necessary to know their nature, their essential qualities, and matter; to be able to read them freely, and without error; to judge of their antiquity by those characters which we have just mentioned with reference to the diplomas; and to render them of use in the sciences. As there are scarcely any of the ancient codes now remaining written on the Egyptian paper, or on wood, ivory, &c. we have only to consider those which are written on parchment or vellum (*membraneos*), and such as are written on our paper (*chartaceos*). The former of these are in most esteem. With regard

Diploma-
tics.

Dipondius to the character, these codices are written either in square and capital letters, or in half square or round and small letters. Those of the first kind are the most ancient. There are no intervals between the words, no letters different from the others at the beginning of any word, no points, nor any other distinction. The codices which are written in half square letters resemble those we have in Gothic characters, as well for the age as the form of the letters. Such as are written in round letters are not so ancient as the former, and do not go higher than the ninth or tenth century. These have spaces between the words, and some punctuation; but they are not so well written as the preceding, and are frequently disfigured with comments. The codices are divided, according to the country, into Lombard, Italian, Gaelic, Franco-Gaelic, Saxon, Anglo-Saxon, and so forth.

8. In the ancient Greek books they frequently terminated the periods of a discourse, instead of all other divisions, by lines, and these divisions were called, in Latin, *versus*, a *vertendo*; for which reason these lines are still more properly named *versus* than *lineæ*. At the end of a work the number of verses of which it consisted was put down, in order that the copies might be more easily collated; and it is in this sense that we are to understand Tribonius, when he says that the Pandects contain 150,000 *pæne versus*. These codices were likewise *vel probæ vel deterioris notæ*, more or less perfect, not only with regard to the calligraphy or beauty of the character, but also with reference to the correctness of the text.

9. It is likewise necessary to observe, in ancient codices, the abbreviations as they have been used in different centuries. Thus, for example, A. C. D. signifies Aulus Caius Decimus; Ap. Cn. Appius Cneius; Aug. Imp. Augustus Imperator. The characters which are called *notæ* are such as are not to be found in the alphabet; but which, notwithstanding, signify certain words. Lastly, the learned divide all the ancient codices into *codices minus raros, rariores, editos, et anecdotos*. The critical art is here indispensably necessary; its researches, moreover, have no bounds, and the more as the use of it augments every day, by the discoveries which are made in languages, and by the increase of erudition. The curious reader will find much learned and valuable information on all these matters in the work entitled *Nouveau Traité de Diplomatique, par deux Religieux de la Congrégation de Saint Maur*, 6 tom. 4to, Paris, 1750-1765.

DIPONDIUS, in the language of Scripture, is used by St Luke to signify a certain coin which was of very little value. Our translation of the passage is, "Are not two sparrows sold for two farthings?" In St Matthew, who relates the same thing, we read "Are not two sparrows sold for a farthing?" The Greek reads *assarion* instead of *as*. Now *assarion*, according to some, was worth half an *as*, that is to say, four French deniers and $\frac{1}{8}$ th; and, according to others, two deniers and $\frac{1}{16}$ th. *Dipondius* seems rather to signify half an *as*. See Calmet, *Diction. Bibl.*; Luke, xii. 6; Matt. x. 29. But Dr Arbuthnot differs in opinion from the author last quoted. He says that this coin was at first *libralis*, or of a pound weight; and that even when diminished, it retained the name of *libella*. So that *dipondius* denotes two asses.

DIPPING, among miners, signifies the interruption or breaking off the veins of ore; an accident which gives them a great deal of trouble before they can discover the ore again. See MINING.

DIPPING Needle, an instrument used for observing the quantity of inclination towards the earth, assumed by any needle or other body after it has acquired the magnetic virtue. This was first observed by one Robert Norman, an Englishman, and a maker of compasses for mariners, in

the end of the sixteenth century, who finding that he was always obliged to counterbalance that end which turns to the north by a bit of wax or such other substance, though the balance had been ever so exact before, published an account of his discovery as a matter of importance. The subject was instantly attended to; and instruments were not only contrived for ascertaining the quantity of the dip, but various speculations were formed concerning the cause of so surprising a phenomenon.

The general phenomena of the dipping needle are, that about the equatorial parts of the earth it remains in a horizontal position, but depresses one end as we recede from these; the north end if we go towards the north, and the south end if we proceed towards the south pole. The farther north or south that we go the inclination becomes the greater; but there is no part of the globe hitherto discovered where it points directly downwards, though it is supposed that it would do so in some part very near the pole. Its inclination is likewise found to vary very considerably at different times in different places of the earth, and by some changes of situation, in such a manner as must appear at first sight very unaccountable. Of all those who have attempted the investigation of this obscure subject, none has been more successful than M. Cavallo, who in his *Treatise on Magnetism* has paid particular attention to all the phenomena, and accounted for them upon plain and rational principles. The voyages to the arctic regions, in search of a north-west passage, have led to a great accumulation of observations by means of the dipping-needle. See MAGNETISM.

DIPPOLDISWALDE, a bailiwick in the kingdom of Saxony, in the circle of Meissen, extending over fifty-five square miles, or 35,200 acres, and containing 9800 inhabitants. The chief place, of the same name, is situated on the river Weisseritz, and contains 246 houses and 1400 inhabitants, occupied in distilleries, in weaving cloth, and in bleaching linen yarn.

DIPSAS, a sort of serpent, the bite of which produces such a thirst as proves mortal; and hence its name *dipsas*, which signifies thirsty. In Latin it is called *situla*, a pail.

DIPTERA (from *dis*, and *πτερον*, wing), in Zoology, an order of insects which have only two wings, and under each wing a style, or oblong body, terminated by a protuberance or head, and called a *balancer*. See ENTOMOLOGY, Index.

DIPTOTES, in Grammar, are such nouns as have only two cases, as *suppetiæ*, *suppetias*, and so on.

DIPTYCHA, in Antiquity, a public register, wherein were written the names of the consuls and other magistrates, among the heathens; and of bishops, and defunct as well as surviving brethren, among the Christians.

The word is formed from the Greek *διπτυχων*, or *διπτυχα*, and that from *διπτυξ*, a masculine noun derived from *πτύσσω*, I fold or plait. From its future *πτυξω* is formed *πτυξ*, a fold or plait, to which adding *dis*, twice, we have *διπτυξ*, in the genitive *διπτυχου*, whence comes the nominative neuter *διπτυχον*, a book folded in two leaves; though there were some in three, and others in four or five leaves. An ingenious author imagines this name to have been first given them in order to distinguish these leaves from the books which were rolled, and hence called *volumina*.

It is certain there were profane diptycha in the Greek empire, as well as sacred ones in the Greek church. The former were the matricula or registers, wherein the names of the magistrates were entered; in which sense diptycha is a term in the Greek chancery.

Sacred DIPTYCHA. The word is plural; diptycha being a double catalogue, in one part of which were written the names of the living, and in the other those of the dead, which were to be rehearsed during the office. We meet

Dippoldis-
walde
||
Diptycha.

Diræ
||
Dis.

with something not unlike the sacred diptycha of the Greeks in the canon of the mass according to the Latin usage, where the people are enjoined to pray once for the living and once for the dead, and where several saints are invoked in different times. In such diptycha were entered the names of bishops, who had governed their flock aright; and these were never expunged, unless they were convicted of heresy or some other gross crime. In the diptycha were likewise entered the names of such as had done any signal service to the church, whether they were living or dead; and mention was made of them in the celebration of the liturgy.

Casaubon, in his observations on Athenæus (lib. vi. cap. 14), supposes the Christians to have borrowed the custom of writing names in a book, and rehearsing them at mass, from the heathens, who entered the names of persons to whom they wished to do any signal honour, in the verses of the Salii, as was done in the case of Germanicus and Verus, sons of the emperor Marcus Aurelius, and a long time before, during the age of the republic; in that of Mamercus Veturius and Lucia Volumnia, as we are told by Tacitus, Spartian, Ovid, Festus, Plutarch, and others. But Rosweyd does not approve of this notion of Casaubon; and the pretended St Dionysius, a very ancient author, asserts that this usage was originally founded on Scripture (2 Tim. ii. 19; Psal. cxvi. 15). Rosweyd adds Ecclesiasticus (xliv. 1), and takes these to have been the passages the ancient church had a view to, rather than the Salian verses.

The profane diptycha were frequently sent as presents to princes and others, on which occasions they were finely gilded and embellished; as appears from Symmachus (lib. ii. ep. 81). Those presented were usually of ivory. The first law, *De Expens. Ludor.* in *C. Theod.* forbids all magistrates below the rank of consuls to make presents of diptycha of ivory in the public ceremonies.

DIRÆ, the general name of the three furies in the Pagan system of mythology. They were so called, as being *quasi deorum iræ*, the ministers of divine vengeance in punishing guilty souls after death. They were accounted the daughters of *Night* and *Acheron*.

DIRECT, in *Arithmetic*, is when the proportion of any terms or quantities is in the natural or direct order in which they stand, being the opposite inverse, which considers the proportion in the inverted order of the terms. So, 3 : 4 :: 6 : 8 directly; or 3 : 4 :: 8 : 6 inversely.

DIRECTION, in *Mechanics*, signifies the line or path of a body's motion, along which it endeavours to proceed according to the force impressed upon it.

DIRECTION, in *Astronomy*, the motion and other phenomena of a planet when direct.

DIRECTION, in *Astrology*, is a kind of calculus, by which it is pretended to find the time in which any notable accident shall befall the person whose horoscope is drawn.

DIRECTOR, in commercial policy, a person who has the management of the affairs of a trading company. Thus we say, the directors of the India Company.

DIRIBITORES, among the Romans, officers appointed to distribute tablets to the people at the comitia.

DIRIGENT, or DIRECTRIX, a term in geometry, signifying the line of motion along which the describing line or surface is carried in the genesis of any plane or solid figure.

DIS, an inseparable article prefixed to various words, the effect of which is either to give them a signification contrary to what the simple words have, as *disoblige*, *disobey*; or to signify a separation or detachment, as *disposing*, *distributing*.

DIS, a god of the Gauls, the same as Pluto the god of hell. The inhabitants of Gaul supposed themselves descended from that deity.

Disability
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Discipline.

DISABILITY, in *Law*, is when a man is disabled, or made incapable to inherit any lands, or take that benefit which otherwise he might have done; and this may happen four ways; by the act of an ancestor, or of the party himself, by the act of God, or by that of the law. 1. Disability by the act of the ancestor is where the ancestor is attainted of high treason, which corrupts the blood of his children, so that they may not inherit his estate. 2. Disability by the act of the party is where a man binds himself by an obligation, that, upon surrender of a lease, he will grant a new estate to a lessee; and afterwards he grants over the reversion to another, which puts it out of his power to perform it. 3. Disability by the act of God is where a man is *non sanæ memoriæ*, by which he is incapable of making any grant, &c.; so that, if he pass an estate out of him, it may after his death be made void: but it is a maxim in law, "that a man of full age shall never be received to disable his own person." 4. Disability by the act of the law, is where a man by the law, without any thing by him done, is rendered incapable of the benefit of the law; as an alien born, or the like.

DISAPPOINTMENT, ISLANDS OF, a cluster of islands in the Southern Pacific Ocean, so named by Commodore Byron, who discovered them in 1765. The island seen by Lord Byron had a beautiful appearance. The middle of this cluster of islands lies in long. 145. 4. W. lat. 14. 5. S.

DISC, in *Antiquity*, a quoit made of stone, iron, or copper, five or six fingers broad, and more than a foot long, inclining to an oval figure, which they hurled in form of a bowl to a vast distance, by the help of a leathern thong tied round the person's hand who threw it, and put through a hole in the middle. Homer has made Ajax and Ulysses great artists at this sport.

Disc, in *Astronomy*, the body and face of the sun and moon, such as they appear to us on the earth; or the body and face of the earth, such as it appears to a spectator in the moon.

Disc, in *Optics*, is the width of the aperture of telescope glasses, whatever their form be, whether plane, convex, concave, &c.

DISCIPLE, one who learns any thing from another; and hence the followers of any teacher, philosopher, &c. are called *disciples*. In the Christian sense, they were followers of Jesus Christ in general; but in a more restrained sense, the disciples denote those alone who were the immediate followers and attendants on his person, of which there were seventy or seventy-two. The names *disciples* and *apostles* are often used synonymously in the gospel history; but sometimes the apostles are distinguished from disciples, or persons selected out of the number of disciples, to be the principal ministers of his religion. Of these last there were only twelve. The Latins kept the festival of the seventy or seventy-two disciples on the 15th July, and the Greeks on the 4th January.

DISCIPLINE, in a general sense, denotes instruction and government, as military discipline, ecclesiastical discipline, and the like.

Ecclesiastical discipline consists in putting those laws in execution by which the church is governed, and inflicting the penalties enjoined by them against the several sorts of offenders who profess the religion of Jesus. The primitive church never pretended to exercise discipline upon any but such as were within her pale, in the largest sense, by some act of their own profession; and even upon these she never pretended to exercise her discipline so far as to cancel or disannul their baptism;—all that she pretended to was to deprive men of the benefits of external communion, such as public prayer, receiving the eucharist, and other acts of divine worship. The church discipline was only confined to the admonition of the

Discipline party, and to the lesser and greater excommunication. As to the objects of ecclesiastical discipline, they were all such delinquents as fell into great and scandalous crimes after baptism.

Discipline, in a more peculiar sense, is used to signify the chastisements or bodily punishments inflicted on a religious person of the Roman Catholic church who has been found a delinquent; or even to indicate that which religious persons voluntarily undergo or inflict on themselves by way of mortification.

Book of DISCIPLINE, in the history of the church of Scotland, is a common order, drawn up by the assembly of ministers in 1650, for the reformation and uniformity to be observed in the discipline and policy of the church. In this book the government of the church by prelates is set aside; church sessions are established; the superstitious observation of fast days and saints' days is condemned; and other regulations for the government of the church are determined. This book was approved by the privy council, and is called the *First Book of Discipline*.

DISCORD, in general, signifies disagreement or opposition between different persons or things.

DISCORD, in *Music*, is every sound which, joined with another, forms an assemblage disagreeable to the ear; or rather, every interval whose extremes do not coalesce. Now, as there are no other concords or consonances, excepting those which form amongst themselves, and with their fundamental sound, perfect chords, it follows that every interval must be a real dissonance or discord; even the third and sixth were reckoned such among the ancients, who excluded them from the number of consonant chords.

The term *dissonance*, which is synonymous with discord, is compounded of two words, namely, the inseparable preposition *dis* and the verb *sonare*; which, both in a literal and metaphorical sense, signifies *disagreement* or *disunion*. In reality, that which renders dissonances grating, is, that the sounds which form them, so far from uniting in the ear, seem to repel each other, and are heard each by itself as two distinct sounds, though produced at the same time.

This repulsion or violent oscillation of sounds is heard more or less, as the vibrations which produce it are more or less frequently coincident. When two vocal strings are gradually tuned till they approach a consonant interval, the pulsations become slower as the chord grows more just, till at last they are scarcely heard, if heard at all; and hence it appears certain, that the pleasure produced in us by harmony results from the more or less exact and frequent coincidence or vibration; though the reason why this coincidence should afford pleasure, more than any other modification or combination of sounds, appears to us inscrutable. The agreeable effects of dissonance in harmony are no objection to this theory; since it is allowed that the sensations excited by discord are not in themselves immediately and necessarily pleasing, but only please by auricular deception. The ear is surprised with the shock it receives, without being able to imagine how it should have happened; and in proportion as it is harsh and grating, we feel the pleasure of returning harmony enhanced, and the disappointment of being artfully and insensibly extricated more agreeable.

The name of *dissonance* is given sometimes to the interval, and sometimes also to each of the two sounds which form it. But though two sounds equally form a dissonance between themselves, this term is most frequently applied to that sound in particular which is most extraneous to the chord.

The number of possible dissonances is indefinite; but as in music we exclude all intervals which are not found in the system received, the number of dissonances is reduced to a very few; besides, in practice we can only se-

lect from those few such as are agreeable to the species, and the mode in which we compose; and from this last number we must exclude such as cannot be used consistently with the rules prescribed. But what, it may be asked, are these rules? Have they any foundation in nature, or are they merely arbitrary? This is what Rousseau, whom in this article we have followed or abandoned as his observations appeared useful or frivolous, purposes to investigate as its principal object.

But where does his scrutiny terminate? Not in the abolition of the rules prescribed. These have still subsisted, and will continue to subsist, while the frame of man, and the nature of music, remain what they are. If, then, the rules be permanent and universal, the principle upon which they are founded may be latent or ambiguous; but the rules themselves can never be purely arbitrary. How else could it happen that Rameau, D'Alembert, and Rousseau should admit the force and effect of these rules, whilst each of these masters exerted his whole genius to give a different account of their cause and origin? Rousseau himself, as we have seen in a former article, inculcates the necessity of dissonances for the completion of harmony. (See CHORD.) Now, if this be true, the easiest methods of introducing and dismissing these discords must be the most eligible, and of consequence the rules for using them must be established. It is not then upon the subsistence or demolition of any particular theory that they depend. Were we to attend to the particular objections which may be urged against any system whatever, where is the theory which will be found proof against the efforts of scepticism? After all, the objections of Rousseau to Rameau's theory, as applied by D'Alembert to the origin of consonances, appear to be much more frivolous than the analogies from which he pretends that this origin was deduced. It appears from D'Alembert's exposition of this theory, that, if not for all, it affords a solution for the most material and essential phenomena in harmony, which is sufficient for its establishment, until another can be found which will give a rational and consistent account of the whole; a discovery which has not yet been made. But whilst we acknowledge the futility of Rousseau's objections against D'Alembert's explication of dissonances, we must at the same time admire the ingenuity with which he has deduced them from principles purely mechanical, without departing from the system of Rameau. This mechanical explication will be found in his *Musical Dictionary*, under the article *Dissonance*.

DISCORD, the goddess of, in Pagan theology. She is represented by Aristides with fiery eyes, a pale countenance, livid lips, and wearing a dagger in her bosom. It was she who at the marriage of Peleus and Thetis threw in the golden apple, on which was written "To the fairest," and which occasioned a contention between the goddesses Juno, Minerva, and Venus, each pretending a title to the apple. She was likewise called *Ate* and *Eris*.

DISCOUNT, in commerce, a term among traders, merchants, and bankers. It is used by the two former on occasion of their buying commodities on the usual term of credit, with a condition that the seller shall allow the buyer a certain discount at the rate of so much per cent. per annum for the time for which the credit is generally given, upon condition that the buyer pays ready money for such commodities, instead of taking the ordinary credit. Traders and merchants also frequently take promissory notes for monies due payable to them or their order at a certain time, and, sometimes having occasion for money before the time is elapsed, get these notes discounted or cashed by bankers before the time of payment. Bills of exchange are also discounted by bankers; and in this consists one article of the profits of banking.

Discord
Discount.

Discrete
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Discussion.

DISCRETE or **DISJUNCT PROPORTION** is when the ratio of two or more pairs of numbers or quantities is the same, but when there is not the same proportion between all the four numbers. Thus, if the numbers 3 : 6 :: 8 : 16 be considered, the ratio between 3 : 6 is the same as that between 8 : 16, and therefore the numbers are proportional; but it is only discretely or disjunctly, for 3 is not to 6 as 6 to 8; that is, the proportion is broken off between 8 and 3, and is not continued as in the following continual proportionals, 3 : 6 :: 12 : 24.

DISCRETE Quantity is such as is not continued and joined together. Such, for instance, is any number.

DISCRETION, the prudence or knowledge necessary to govern one's self properly.

There are many more shining qualities in the mind of man, but there is none so useful as discretion. It is this indeed which gives a value to all the rest, which sets them at work in their proper times and places, and turns them to the advantage of the person who is possessed of them. Without discretion learning is pedantry, and wit impertinence; virtue itself looks like weakness; and the best parts only qualify a man to be more sprightly in errors, and active to his own prejudice.

Nor does discretion only make a man master of his own parts, but of other men's. The discreet man finds out the talents of those he converses with, and knows how to apply them to proper uses. Accordingly, if we look into particular communities and divisions of men, we may observe that it is the discreet man, not the witty, nor the learned, nor the brave, who guides the conversation, and prescribes measures to the society. A man with great talents, but void of discretion, is, like Polyphemus in the fable, strong and blind, endued with an irresistible force, which for want of sight is of no use to him. Though a man have all other perfections, and yet want discretion, he will be of no great consequence in the world; but if he have this single talent in perfection, and but a common share of other endowments, he may do what he pleases in his particular station of life.

It is proper, however, to distinguish between *discretion* and *cunning*; the latter being the accomplishment only of little, mean, ungenerous minds. Discretion points out the noblest end to us, and pursues the most proper and laudable methods of attaining them; cunning has only private and selfish aims, and it sticks at nothing which may make them succeed. Discretion has large and extensive views, and, like a well-formed eye, commands a whole horizon; cunning is a kind of short-sightedness, which discovers the minutest objects that are near at hand, but is not able to discern things at a distance. Discretion, the more it is discovered, gives the greater authority to the person who possesses it; cunning, when it is once detected, loses its whole force, and makes a man incapable of bringing about even those events which he might have done had he passed only for a plain man. Discretion is the perfection of reason, and a guide to us in all the duties of life; cunning is a kind of instinct, which only looks out after our immediate interest and welfare. Discretion is only found in men of strong sense and good understanding; cunning is often to be met with even in brutes themselves, and in persons who are but few removes from them. In short, cunning is only the mimic of discretion, and may pass upon weak men for that which it imitates; in the same manner as vivacity is often mistaken for wit, and gravity for wisdom.

DISCUSSION, in matters of literature, signifies the clear treating or handling of any particular point or problem, so as to shake off the difficulties with which it is embarrassed. Thus we say, *such a point was well discussed*, when it was properly treated and cleared up.

Discu-
tients
||
Dispart.

DISCUTIENTS, in *Medicine*, are such remedies as, by their subtilty, dissolve a stagnating or coagulate fluid, and dissipate the same without an external solution of continuity.

DISDIACLASTIC CRYSTAL, in *Natural History*, a name given by Bartholine and some others to a mineral substance, more usually called, from the place whence it was first brought, *Iceland crystal*. See **MINERALOGY**.

DISDIAPASON, or **BISDIAPASON**, in *Music*, a compound concord, described by Parran, in the quadruple ratio of 4 : 1, or 8 : 2.

DISDIAPASON Diapente, a concord in a sextuple ratio of 1 : 6.

DISDIAPASON Semi-Diapente, a compound concord in the proportion of 16 : 3.

DISDIAPASON Ditone, a compound consonance in the proportion of 10 : 2.

DISDIAPASON Semi-Ditone, a compound concord in the proportion of 24 : 5.

DISEASE has been variously defined by physicians, almost every founder of a new system having given a definition of it, differing in some respects from his predecessors. See **MEDICINE**.

DISEMBOGUE. When a ship passes out of the mouth of some great gulf or bay, this is called *disemboguing*. It is usual also to say of a river, that at such a place, or after it has run so many leagues, it disembogues itself into the sea.

DISFRANCHIZING, among civilians, signifies the depriving a person of the rights and privileges of a free citizen or subject.

DISGUISE, a counterfeit habit. Persons doing unlawful acts in disguise are by our statutes sometimes subjected to severe penalties, and even declared felons. Thus, by an act commonly called the *black act*, persons appearing disguised and armed in a forest or grounds enclosed, or hunting deer, or robbing a warren or a fish-pond, are declared felons.

DISH, in mining, is a trough made of wood, about twenty-eight inches long, four inches deep, and six inches wide, by which all miners measure their ore. If any be taken selling their ore, not having first measured it by the bar-master's dish, and paid the king's duty, the seller forfeits his ore, and the buyer forfeits for every such offence forty shillings to the lord of the field or farmer.

DISJUNCTIVE, something which separates or disjoins. Thus, *or, neither, &c.* which, in connecting a discourse, yet separate the parts of it, are called *disjunctive conjunctions*.

DISLOCATION, the putting a bone out of joint by some violence, usually called by the physicians *luxation*.

DISNA, a circle of the Russian government of Minsk. The river Düna affords the means of conveying wood, which is its chief produce, to Riga. It grows corn for its consumption, and some flax, which is also sent to Riga. The chief town, of the same name, stands at the junction of the river Dina with the Düna. Long. 27. 35. E. Lat. 54. 34. N.

DISPART, in *Gunnery*, is the setting a mark upon the muzzle ring, or thereabouts, of a piece of ordnance, so that a sight-line taken upon the top of the base ring against the touch-hole, by the mark set on or near the muzzle, may be parallel to the axis of the concave cylinder. The common way of doing this is to take the two diameters of the base ring, and of the place where the dispart is to stand, and divide the difference between them into two equal parts, one of which will be the length of the dispart which is set on the gun with wax or pitch, or fastened there with a piece of twine or marlin. By means of an instrument it may be done with all possible nicety.

Dispatch
||
Disper-
sion.

DISPATCH, a letter on some affair of state or other business of importance, sent with care and expedition, by a courier express. The business of dispatches is conducted by the secretaries of state and their clerks. The king gives directions to his ministers abroad by dispatches. The word is also used for the packet or mail containing such letters. The French, during the reign of Louis XIV., had a *conseil des dépêches*, or council of dispatches, held in the king's presence, at which the dauphin, the Duke of Orleans, the chancellor, and four secretaries of state, assisted.

DISPAUPER. A person suing *in forma pauperis* is said to be dispaupered, if, before the suit be ended, he have any lands or other estate fallen to him, or if he have done any thing to make him lose his privilege.

DISPENSARY, or **DISPENSATORY**, denotes a book containing the method of preparing the various kinds of medicines used in pharmacy. Such are those of Bauderon, Quercetan, Zwelfer, Charas, Bate, Mesue, Salmon, Lemery, Quincy, and others; but the latest and most esteemed, besides the London and Edinburgh pharmacopœias, is the Edinburgh New Dispensatory, being an improvement upon that of Dr Lewis.

DISPENSARY, or *Dispensatory*, is likewise a magazine or office for selling medicines at prime cost to the poor. The College of Physicians maintain three of these in London; one at the College itself in Warwick Lane, another in St Peter's Alley, Cornhill, and a third in St Martin's Lane. Dispensaries have also been established in several of the principal towns in Scotland and England.

DISPERSION, in general, signifies the scattering or dissipating something. Hence

DISPERSION, in *Optics*, is the same with the divergency of the rays of light.

Point of DISPERSION is the point from which refracted rays begin to diverge, where their refraction renders them divergent.

DISPERSION of Mankind, in the history of the world, was occasioned by the confusion of tongues, and took place in consequence of the overthrow of Babel at the birth of Peleg (whence he derived his name); and by the account given of his ancestors (Gen. chap. xi. 10-16) this appears to have happened in the 101st year after the Flood, according to the Hebrew chronology, and by the Samaritan computation in the 401st. However, various difficulties have been suggested by chronologists concerning the true era of this event. Sir John Marsham and others, in order to reconcile the Hebrew and Egyptian chronologies, maintain a dispersion of mankind before the birth of Peleg; whilst others, unable to find numbers sufficient for the plantation of colonies in the space of 101 years, according to the Hebrew computation, fix the dispersion towards the end of Peleg's life, thus following the computation of the Jews. Petavius assigns the 153d year after the Flood; Cumberland the 180th; and Usher, though he generally refers it to the time of Peleg's birth, in one place assigns the 131st after the Flood for this event. Mr Shuckford supposes the dispersion to have been gradual, and to have commenced with the separation of some companies at the birth of Peleg, and to have been completed thirty-one years afterwards. According to the calculation of Petavius, the number of inhabitants on the earth at the birth of Peleg amounted to 32,768; but Cumberland makes them 30,000; Mr Mede states them at only 7000 men, besides women and children; and Mr Whiston, who supposes that mankind now double themselves in about 400 years, and that they doubled themselves between the deluge and the time of David in sixty years at a medium, when their lives were six or seven times as long as they have been since, by his computation produces about 2389; a number much too inconsiderable for the purposes of separating and forming

distinct nations. This difficulty induced Mr Whiston to reject the Hebrew and to adopt the Samaritan chronology, as many others have done; which, by allowing an interval of 401 years between the Flood and the birth of Peleg, furnishes, by the last-mentioned mode of computation, more than 240,000 persons.

As to the manner of the dispersion of the posterity of Noah from the plain of Shinar, it was undoubtedly conducted with the utmost regularity and order. The sacred historian informs us that they were divided in their lands, every one according to his tongue, according to his family, and according to his nation (Gen. x. 5, 20, 31); and thus, as Mr Mede observes, they were ranged according to their nations, and every nation was ranged by its families, so that each nation had a separate lot, and each family a separate share in what fell to every nation. The following abstract will serve to give a general idea of their respective settlements. Japhet, Noah's eldest son, had seven sons. Of these, Gomer was he whose descendants inhabited those parts of Asia which lie upon the Ægean Sea and Hellespont northward, containing Phrygia, Pontus, Bithynia, and a great part of Galatia. The Galatians, according to Josephus, were called *Gomerai*; while the Cimmerii, according to Herodotus, occupied this track of country; and from these Gomerians, Cimmerii, or Celts, Mr Camden derives our ancient Britons, who still retain the name *Cymru* or *Cymri*. Magog, the second son of Japhet, was probably the father of the Scythians on the east and north-east of the Euxine Sea. Madai planted Media, though Mr Mede assigns Macedonia to his share. Javan was the father of the Grecians about Ionia, whose country lies along the coast of the Mediterranean Sea; the radices of Javan and Ionia being the same. To Tubal and Meshech belonged Cappadocia and the country which lies on the borders of the Euxine Sea; and from them, migrating over Caucasus, it is supposed the Russians and Muscovites are descended. Tiras occupied Thrace. The sons of Shem were five: Elam, whose country lay between the Medes and Mesopotamians, and was called by the Gentile writers *Elemais* (Josephus calls the Elamites the founders of the Persians); Ashur, who was driven out of Shinar by Nimrod, afterwards settled in Assyria, and there built Nineveh and other cities; Arphaxad, who gave name to the country which Ptolemy calls *Arraphacitis*, a province of Assyria, though Josephus makes him the father of the Chaldees; Lud, who inhabited and gave name to the country of Lydia, about the river Mæander, remarkable for its windings, in Asia Minor; and Aram, the father of the Syrians. Ham, the youngest son of Noah, had four sons: Cush, whose posterity spread into the several parts of Arabia over the borders of the land of Edom, into Arabia Felix, up to Midian and Egypt; Mizraim, the father of them who inhabited Egypt and other parts of Africa; Phut, to whom Bochart assigns the remaining part of Africa, from the Lake of Tritonides to the Atlantic Ocean, called *Libya*; and Canaan, to whom belonged the land of Canaan, whence the Phœnicians derived their origin.

Dr Bryant has advanced a new hypothesis on this subject, and supported it with his usual acuteness and learning. He maintains that the dispersion as well as the confusion of tongues was local, and limited to the inhabitants of the province of Babel; that the separation and distribution recorded to have taken place in the days of Peleg (Gen. x. 25, 31, 32), which was the result of divine appointment, occasioned a general migration; and that all the families amongst the sons of men were concerned in it. The house of Shem, from which the Messiah was to spring, was particularly regarded in this distribution. The portion of his children was near the place of separation; they

Displayed in general had Asia to their share, as Japhet had Europe, and Ham the large continent of Africa. But the sons of Cush would not submit to the divine dispensation. They went off under the conduct of Nimrod, and seem to have been for a long time in a roving state. However, at last they arrived at the plains of Shinar; and having ejected Ashur and his sons, who were placed there by divine appointment, seized his dominions, and there laid the foundation of a great monarchy. But afterwards fearing lest they should be divided and scattered abroad, they built the tower of Babel as a land-mark to which they might repair, and probably to answer the purposes of an idolatrous temple, or high altar, dedicated to the host of heaven, from which they were never long to be absent. They only, viz. the sons of Cush, or the Cushites, and their associates from other families, who had been guilty of rebellion against divine authority, and of wicked ambition and tyranny, were punished with the judgment of confounded speech through a failure in labial utterance, and of the dispersion recorded in Genesis; in consequence of which they were scattered abroad from this city and tower, without any certain place of destination. The Cushites invaded Egypt, or the land of Mizraim, in its infant state, seized the whole country, and held it for some ages in subjection; and they extended likewise to the Indies and Ganges, and still farther in China and Japan. From them the province of Cushan or Goshen in Egypt derived its name. Here they obtained the appellation of royal shepherds; and when they were by force driven out of the country, after having been in possession of it for 260 or 280 years, the land which they had been obliged to quit was given to the Israelites, who were also denominated "shepherds," but should not be confounded with the former, or the antecedent inhabitants of Goshen.

DISPLAYED, in *Heraldry*, is understood of the position of an eagle, or any other bird, when it is erect, with its wings expanded or spread forth.

DISPONDEE, in the Greek and Latin poetry, a double spondee or foot, consisting of four long syllables; as cōnclūdētēs.

DISQUISITION (from *dis*, and *quæro*, I inquire), an inquiry into the nature, kinds, and circumstances of any problem, question, or topic; in order to gain a right notion of it, and to discourse clearly concerning it.

DISS, a market-town in the hundred of the same name, in the county of Norfolk, ninety miles from London. It is built on one of the upper branches of the river Waveney. There is a good market, which is held on Friday. The inhabitants amounted in 1801 to 2246, in 1811 to 2590, in 1821 to 2764, and in 1831 to 2934.

DISSECTION, in *Anatomy*, the cutting up a body with a view of examining the structure and use of the parts. Legendre observes that the dissection of a human body, even dead, was held as a sacrilege until the time of Francis I. And the same author assures us he has seen a consultation held by the divines of Salamanca, at the request of Charles V. in order to settle the question whether or not it were lawful in point of conscience to dissect a human body in order to learn the structure thereof.

DISSEISIN, in *Law*, an unlawful dispossessing a person of his lands or tenements.

DISSENTERS, separatists from the service and worship of any established church.

DISSIDENTS, a denomination applied in Poland to those of the Lutheran, Calvinistic, and Greek professions.

DISSIMULATION, the act of dissembling, by means of false appearances or pretensions.

DISSIPATION, in *Physics*, an insensible loss or consumption of the minute parts of the body, or that flux by which they escape and are lost.

Circle of DISSIPATION, in *Optics*, is used for that circular space upon the retina, which is taken up by one of the extreme pencils of rays issuing from an object.

DISSOLVENT, in general, whatever dissolves or reduces a solid body into such minute parts as to be sustained in a fluid.

DISSOLUTION, in *Physics*, a discontinuation or analysis of the structure of a mixed body, by which what was one and contiguous is divided into parts, either homogeneous or heterogeneous.

Dissolution, then, is a general name for all reductions of concrete bodies into their smallest parts, without any regard either to solidity or fluidity; though, in the usual acceptation of the word among authors, it is restricted to the reduction of solid bodies into a state of fluidity; but this is more properly expressed by *solution*, as a branch of *dissolution*.

DISSONANCE, in *Music*. See DISCORD.

DISSYLLABLE, among grammarians, a word consisting of only two syllables; such as nature, sciences.

DISTAFF, an instrument about which flax is tied in order to be spun.

DISTANCE, in general, an interval between two things, with regard either to time or place.

Accessible DISTANCES, in *Geometry*, are such as may be measured by the chain.

Inaccessible DISTANCES are such as cannot be measured by the chain, by reason of some river, or the like, which obstructs the passage from one object to another.

DISTANCE, in *Astronomy*. The distance of the sun, planets, and comets, is found only from their parallax, as it cannot be found either by eclipses or their different phases; for, from the theory of the motions of the earth and planets, we know, at any time, the proportion of the distances of the sun and planets from us; and the horizontal parallaxes are in a reciprocal proportion to these distances.

DISTASTE properly signifies an aversion or dislike to certain kinds of food, and may be either constitutional, or owing to some disorder of the stomach.

DISTEMPER, among *Physicians*, the same with DISEASE.

DISTEMPER, in *Painting*, a term used for the working up of colours with something besides water or oil. If the colours are prepared with water, that kind of painting is called *limning*; and if with oil, it is called *painting in oil*, and simply *painting*. If the colours are mixed with size, whites of eggs, or any such glutinous or unctuous matter, and not with oil, then it is said to be done in *distemper*.

DISTENSION, in general, signifies the stretching or extending a thing to its full length or breadth.

DISTICH, a couplet of verses making complete sense. Thus hexameter and pentameter verses are disposed in distichs. There are excellent morals in Cato's distichs.

DISTICHIASIS, in *Surgery*, a disease of the eyelids, when under the ordinary eye-lashes there grows another extraordinary row of hairs, which frequently eradicates the former, and, pricking the membrane of the eye, excites pain, and brings on a defluxion. It is cured by pulling out the second row of hairs with nippers, and cauterizing the pores out of which they are extracted.

Dis-
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DISTILLATION.

Distilla-
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THE preparation of ardent spirits constitutes a manufactory which is carried on in this country to a considerable extent, and deserves a particular investigation, as connected with one of the most curious and intricate departments of chemistry. We shall treat the subject as briefly as is compatible with perspicuity and utility.

It seems established by the experiments of chemists, that no other substance can be converted into ardent spirits, by fermentation, than sugar. Different species of sugar have been recognized by chemists. They are distinguished from each other by their sweetening power, and by the figure of their crystals. As far as the process of distillation is concerned, it seems only necessary to refer to three of these species; namely, *common sugar*, *sugar of grapes*, or *sugar of starch* and *manna*.

Common sugar is usually extracted from the sugar cane, but it exists likewise in beet, and in various other vegetable substances. Its colour is white, and it crystallizes in rhomboidal prisms. When it is dissolved in a sufficient quantity of water, and mixed with yeast, it ferments, and the liquid thus fermented yields, when distilled, an ardent spirit. It is from the refuse of common sugar that the ardent spirit well known by the name of *rum* is obtained in the West Indies.

Sugar of grapes is the substance to which that fruit is indebted for its sweet taste. It may be extracted from the juice of grapes, by nearly the same process as is followed by the manufacturers of common sugar. It is white, not so sweet as common sugar, and not so soluble in water. It usually crystallizes in spheres. These, when viewed with a glass, are found to consist of a congeries of small acicular crystals diverging from a centre. It is to the presence of this sugar that the juice of grapes owes its fermentability. The ardent spirits obtained by distilling *wine* are usually distinguished by the name of *brandy*. They are manufactured in great abundance in France and Spain, and other wine countries.

When starch is boiled with a large quantity of water and a little sulphuric acid for a considerable time, it is converted into a sugar, which possesses exactly the properties of sugar of grapes. From the experiments of M. Theodore de Saussure, it seems to follow that this sugar is nothing more than a combination of starch with water. During the process of malting, the starch which constitutes so great a portion of barley is converted into this sugar. If barley meal be mashed with water of the temperature 150°, and the mixture be well agitated for an hour or two, the barley starch gradually undergoes a process somewhat similar to mashing; for it becomes soluble in the water, and that liquid acquires a sweet taste. It is from this sugar that the ardent spirits known in this country by the names of *Geneva*, *Whisky*, *Gin*, are obtained.

Manna is a saccharine substance, which exudes spontaneously from the *Fraxinus ornus*, and several other species of ash. The fermented juice of the onion, melon, and carrot, likewise contains manna. Manna has a sweet taste like sugar. It is more soluble both in water and alcohol; it crystallizes very readily on cooling, in needles. But its most remarkable property is, that when dissolved in water, and mixed with yeast, it cannot be made to ferment like common or grape sugar. Hence it is incapable of yielding an ardent spirit. To the distiller, therefore, it is totally useless.

Milk likewise contains a peculiar species of saccharine matter, distinguished by the name of *sugar of milk*. In

consequence of the presence of this substance, milk is capable of being fermented into an intoxicating liquor, which, of course, if distilled, would yield an ardent spirit. This liquor is made by the Tartars, from the milk of mares, and is known by the name of *koumiss*. It is made likewise in Shetland.

The liquid which exudes from the cocoa-nut tree also contains a saccharine matter, but of what species has not been ascertained. In consequence of the presence of this saccharine matter, it runs readily into fermentation, and when the fermented liquor is distilled, it yields an ardent spirit, well known in India by the name of *arrack*.

Thus the name of the ardent spirits differs according to the material employed in its manufacture. Every species of ardent spirit is distinguished by a peculiar flavour. The opinion entertained at present is, that the nature of the substance which produces intoxication is the same in all these ardent spirits, and is the substance to which chemists have given the name of *alcohol*; and that the flavour is owing to the presence of an essential oil, derived from the ingredient employed in the manufacture. Thus the sugar cane yields the oil that gives the peculiar flavour to rum; grapes contain the oil that gives the peculiar flavour to brandy, and so on. We do not know that this opinion, though sufficiently probable in itself, has ever been established by decisive experiments; that the oils to which these spirits owe their flavour have ever been obtained in a separate state; or that all of these spirits have been made to yield alcohol destitute of flavour. But the opinion is so very likely to be true, that we will be forgiven for adopting it, especially as we are not aware of any counter evidence that can be brought forward.

The processes of the distiller being essentially the same, whatever the substance be from which he procures his *ardent spirits*, we shall satisfy ourselves with a minute account of the processes followed by the distillers in Scotland in manufacturing whisky. We shall introduce, likewise, a few observations on the processes followed in manufacturing ardent spirits in other countries, such as Holland and Rum; and we shall terminate the article by giving the present state of our knowledge of the theory of fermentation.

CHAP. I.—OF THE MANUFACTURE OF WHISKY.

The kind of grain employed in this country for manufacturing whisky is *barley*. The processes are easier, and the spirits produced have a more agreeable flavour, when the barley is *malted*. But, in consequence of the duty upon malt, a portion of unmalted grain has been introduced into the distilleries. This portion has been gradually increased, and amounts very commonly to four fifths, and in some cases, it is said, to nine tenths, of the whole mixture of raw grain and malt. It may be laid down as a general rule, that the labour bestowed, and the time requisite for brewing, increases in proportion to the quantity of raw grain employed.

The processes of the distiller may be reckoned four: namely, the mashing, the cooling, the fermenting, and the distilling. We shall take each of these processes in the order in which we have named them.

1. *The Mashing.*

The barley is previously ground to a fine meal, and the malt bruised by passing it between rollers. When the

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proportion of malt is very small, it is customary to add a quantity of the *seeds* of oats (the husk of oats separated during the grinding), to facilitate the separation of the water from the grains, after the process of mashing is over; for barley-meal parts with water with much greater difficulty than malt. When the proportion of raw grain to malt is as 2 to 1, or even as 3 to 1, this addition of oat seeds may be dispensed with. But it is probably essential when the proportions amount to 5 to 1, or, still more, when to 9 to 1.

The quantity of grain and malt employed at one time must be entirely regulated by the size of the distillery. But, that we may be able to give a precise notion of the proportion of the different substances employed, we shall suppose the quantity taken at once to be 60 bushels, and that it consists of a mixture of two parts raw grain and one part malt, or,

40 bushels barley,
20 bushels malt.

The mash-tun is a large circular or square vessel, which now-a-days is usually constructed of cast iron. It was formerly of wood; but a wooden mash-tun was found to last for so short a time, that iron has been substituted in several distilleries with which we are acquainted, and probably the substitution will soon become general. Into the mash-tun a quantity of water is let down of the temperature 150° Fahrenheit. The bulk of this water varies according to the fancy of the distiller; but from 700 to 800 wine gallons may be reckoned a good proportion for sixty bushels of grain. The mixture of meal and bruised malt is then put into the mash-tun, and very carefully mixed with the water by a number of men, who wield each a wooden instrument adapted for the purpose. All the dry clots of meal are broken, and every portion of it wetted with the water. This agitation of the meal in the water is what is technically called *mashing*. It is continued for at least an hour and a half, sometimes much longer; and the length of time must increase with the proportion of raw grain present, when compared with the malt; so that sometimes we have seen it continued for three or even four hours. As the liquor in the mash-tun would lose a great deal of its heat during this length of time, about 500 wine gallons of water are added at intervals, at a temperature varying from 190° to 205°, according to the fancy of the brewer. After the mashing is concluded, the whole mixture is allowed to remain at rest for about two hours, and this interval is technically called the *infusion*. During this interval the grains sink to the bottom, and the *wort*, still muddy, but quite liquid, remains at the surface.

If we have the curiosity to taste the wort every half hour from the commencement of the mashing to the end of the process, we shall find that at first it has little taste, but that it becomes sweeter and sweeter, till at last it acquires very nearly the luscious sweet taste of malt wort. This indicates clearly that the starch of the barley meal is gradually converted, during the mashing, into starch sugar. In what way this change is produced we have at present no experiments to determine; but if Theodore de Saussure's theory of the formation of starch sugar be accurate, we may conclude that the change is produced simply by the combination of a portion of water with the starch. The conversion, however, in the mash-tun, is never complete. A considerable portion of the starch still remains unaltered. The consequence is, that if we endeavour to make wort from raw grain, as strong as pos-

sible, to contain, for example, 200 lbs. of saccharine matter per barrel, we find ourselves unable to effect our object, because, long before it has reached 200 lbs. per barrel, the wort has lost its fluidity, and has assumed the form of a jelly. Our mode of trying this experiment was, to take the strongest raw grain wort which we could procure, and to concentrate it by boiling, till it became as strong as possible. We were never able, by this method, to obtain a wort much stronger than 150 lbs. per barrel. But malt wort may be easily boiled down to the strength of 200 lbs. per barrel, without losing its fluidity.

Probably the change of the starch into sugar continues during the process of fermentation. Hence, we conceive, the reason why distillers find it advantageous to put into the fermenting tuns all the solid starchy matter which had precipitated from the wort while in the coolers. Hence, also, the reason why the fermentation is conceived to go on best when it comes on gradually at first, and not with too much violence.

After the mashing and infusion is finished, the wort is drawn off from the grains. This is not done, as is the practice with the brewers, by opening a cock at the bottom of the mash-tun. It will not in this way pass through barley meal. But it is drawn off from the top of the mash-tun, after the grains have subsided, by means of a tube pierced full of holes, which rises at one of the corners of the mash-tun as high as the surface of that vessel.

The quantity of wort that runs off in this way does not exceed one third of the water which had been mashed with the meal. If 1200 gallons of hot water, for example, have been employed in all, the wort drawn off after the mashing will scarcely exceed 400 gallons. If the process were carried no farther, almost two thirds of the wort would be lost. To prevent this, about 500 gallons of water, of the temperature 190°, are let upon the grains. The whole is well mixed together for about twenty minutes, and then allowed to *infuse*, or to remain at rest, for an hour and a half. It is then drawn off in the same way as the first wort. In general, the amount of the second wort is greater than of the first, because the grains having been previously deprived of a great proportion of their starch, now part with their water more freely than before.

To carry off everything soluble from the grains as completely as possible, after the second worts have been drawn off, about 800 gallons of boiling hot water are let on the grains. The mashing or stirring is continued for twenty minutes, and the infusion for half an hour or forty minutes. This third wort is then drawn off. Being much weaker than the two preceding worts, some distillers are in the habit of reserving it, and employing it for mixing with the meal and malt in the succeeding brewing. Others boil it down to the requisite strength, and then mix it with the first and second worts in the fermenting vessel. It is impossible to lay down any rule respecting this part of the process, because, unfortunately, the distiller is not left at liberty to follow his own judgment. The legislature has interfered, and obliged him to produce a determinate quantity of spirits of a given strength from 100 gallons of the fermented wort. Till within these few years it was necessary in Scotland to produce from 100 gallons of fermented wort, 19 gallons of spirits of the strength one to ten over hydrometer proof, or of the specific gravity 0.90917. This law, we believe, still exists in England; but in Scotland the quantity of spirits from 100 gallons of fermented wort has been reduced to 14 gallons.¹ The Scotch dis-

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tion.

¹ Still more lately, an act of parliament has passed, reducing the product of spirits to thirteen gallons from the hundred gallons of wash, and the strength of the wort must not exceed 70 lbs. of saccharine matter per barrel. The excise regulations bind down the distiller to a particular mode of operating. All such restrictions are very injurious to the improvement of the process. How far they may have been provoked by the attempts of the manufacturer to evade the excise duties, we pretend not to say.

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tiller at present is under the necessity of producing this quantity of spirits from 100 gallons of fermented wort, or, at any rate, of paying the duty for that quantity, whether he produce it or not. This law, of course, regulates the strength of his wort. For, in order to produce that quantity, it is necessary that the wort should contain a certain proportion of saccharine matter. Accordingly, the wort must be at least of the strength $55\frac{1}{3}$ lbs. per barrel when it is let down into the fermenting tun, and the law prohibits it from being stronger than 75 lbs. per barrel. If we suppose the whole saccharine matter contained in the wort to be decomposed during the fermentation, 100 wine gallons would produce 14 gallons of spirits of the specific gravity 0.90917, provided the original strength of the wort was $55\frac{1}{3}$ lbs. per barrel. But this is a supposition which is never realized in practice. From a number of experiments, conducted with considerable care, we consider ourselves warranted in concluding, that, even when the fermentation is conducted with the greatest success, the quantity of saccharine matter which will remain undecomposed in a barrel of wort of the original strength of $55\frac{1}{3}$ lbs. per barrel, cannot be less than 15 lbs. Hence a distiller can scarcely be expected to produce 14 gallons of spirits of the specific gravity 0.90917 from 100 gallons of wort, unless the original strength of his wort was at least $70\frac{1}{3}$ lbs. per barrel. In general, indeed, a still greater strength than this will be requisite. Now, to produce wort of the strength $70\frac{1}{3}$ lbs. per barrel from raw grain, without boiling, is by no means an easy task. Formerly, when the product necessary was 19 gallons of spirits from the 100 of wort, the distillers were accustomed to give their wort the requisite strength by the process which they termed *lobbing*. This consisted in making up a very strong infusion of saccharine matter from malt, raw grain, &c. and adding it to the wort till it acquired the requisite strength. This substance was likewise called *bub*; and every distiller had his own method of preparing it. Probably sugar, treacle, or other similar prohibited articles, often found their way into it. It was on this supposition that the addition of it to wort was entirely prohibited in the late act of parliament regarding the Scotch distilleries. And it was to prevent the secreting of the surplus spirits which might be produced above the 14 per cent. that the strength of the worts was limited to the maximum 75 lbs. per barrel.

When the quantities of grain, malt, and water, above indicated, are employed, the first worts drawn off will be about the strength of 73 lbs. per barrel, and the second worts of the strength 50 lbs. per barrel; and the two, when mixed together, would constitute a wort of the strength of about 62 lbs. per barrel. Of course, the worts actually made by the Scotch distillers must exceed the strength of those which we have employed by way of illustration, by about eight lbs. per barrel. But we have reason to believe that 62 lbs. per barrel would be a better strength than that pitched upon by those who contrived the act of parliament by which the Scotch distilleries are regulated. Wort of such strength should yield about 12 per cent. of spirits of the strength one to ten over proof, or of the specific gravity 0.90917. The original strength of the wort from which Dutch Hollands is made is considerably less than this, and we believe that nobody will deny that the Dutch spirit is, in general, much preferable to the whisky manufactured in the lowlands of Scotland.

The whisky made by smugglers in Scotland is universally preferred by the inhabitants, and is purchased at a higher price, under the name of Highland whisky. This is partly owing to its being made entirely from malt; but the chief reason is, that, from the unfavourable circumstances under which they operate, their wort is necessa-

rily much weaker than the wort of the legal distillers. Probably it is not much stronger at an average than the wort of the Dutch Hollands. It has been generally conceived that the superiority of the illicitly distilled, or Highland whisky as it is called, is owing to the mode of distillation. The smugglers distil in a much slower way than the legal distillers. But nothing can be more absurd than this opinion. The flavour of the spirits depends entirely upon the previous steps of the process. The slowness or rapidity of the distillation can make no difference whatever in the flavour, provided it be properly performed. Accordingly, we have seen spirits distilled by the very rapid mode of distillation that formerly was practised in Scotland, possessed of all the flavour of the best Highland whisky.

Great pains have been taken to put an end to the practice of illicit distillation in Scotland; and, by greatly diminishing the duty, this object, of late years, has been nearly attained. The smugglers formerly set the whole force of government at defiance, and carried on their processes in spite of all the attempts that were made to stop them. Many of them, indeed, were brought to absolute ruin, and few of them, we believe, were ever able to realize much money, or to rise to independence. But still a new race of smugglers rose up after another to carry on their illicit trade, to the great detriment of the revenue, and to an equal deterioration of the morals of the common people. Government do not seem to have been aware of the principal reason of the continuance of this evil. They bound down the legal distillers in such a manner by injurious restrictions, that it was not in their power to produce a spirit equal in flavour to that manufactured by the smugglers, who lie under none of those restrictions which bind down the ingenuity of the legal trader. This superiority induces a corresponding desire in the inhabitants of Scotland to possess themselves of smuggled whisky, even at a higher price than that for which they can purchase the same article from the licensed distillers. The smugglers, in consequence, are winked at, or rather encouraged, by a very considerable proportion of the inhabitants of the country. While this feeling existed it was impossible to put an end to smuggling in Scotland. But government of late has removed the restrictions by which the Scotch distillers were bound, so far as to allow them to distil from malt at nearly the same rate as they formerly did from raw grain. The consequence has been, that the high reputation of smuggled whisky has gradually sunk, and smuggling has been nearly discontinued.

The only reason that was alleged for continuing the restrictions under which the distillers were placed, was the allegation that they were necessary in order to ensure the payment of the duty upon the spirits actually distilled. But we conceive that this duty might be levied with as much accuracy, though all the restrictions on the strength of the wort were removed. From a number of experiments conducted upon a large scale, we conclude that the fermentation, however successful, is capable of decomposing only four fifths of the whole saccharine matter contained in the wort. Farther, we find, that for every pound of saccharine matter decomposed by the fermentation, there is formed half a pound of alcohol of the specific gravity 0.825. Now every gallon of spirits of the specific gravity 0.90917, or one to ten over proof, contains 4.6 lbs. of alcohol of the specific gravity 0.825. To form a gallon of spirits, then, of the specific gravity 0.90917, there is required the decomposition of 9.2 lbs. of saccharine matter. But as only four fifths of the saccharine matter present are decomposed, we must increase 9.2 by a fifth, which will raise it to $11\frac{1}{5}$ lbs. The rule, therefore, for levying the duty on the distillers would be this. Ascertain,

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by the saccharometer, the strength of the wort, or the number of pounds avoirdupois of saccharine matter which it contains, and for every $11\frac{1}{2}$ of these pounds charge the duty upon one gallon of spirits. This would be no hardship upon the distiller. If he is unable to produce a gallon of spirits from $11\frac{1}{2}$ lbs. of saccharine matter, he is not sufficiently acquainted with his business, and the necessity of paying the duty would stimulate his ingenuity to acquire the requisite information. He would soon discover two facts which would probably regulate his conduct; namely, that the flavour, and consequently the value, of his spirits, increases as he diminishes the strength of his wort, and that the produce of spirits from the same quantity of grain increases also as he diminishes the strength of his wort.

It would be difficult, according to the method at present followed by the distillers, for the excisemen to determine the strength of the worts with the requisite degree of accuracy; but it would be easy, we conceive, to order matters so, that this information might be gained without in the least injuring the process of fermentation to which these worts are to be subjected.

Some distillers, not satisfied with three mashes, which they think insufficient to exhaust the grains of all the matter that may be useful in the formation of spirits, add a fourth quantity of boiling water, after the worts of the third mash are drawn off, and mash a fourth time. The worts of this fourth mash are always kept, to be employed instead of pure water during next day's brewing.

2. The Cooling.

Wort from raw grain has a much greater tendency to run into acidity than wort from malt. On that account the distillers endeavour to bring it down to the temperature requisite to begin fermentation as speedily as possible. As soon as the first worts have begun to run into the underback, they are made to pass into the coolers. The nature and disposition of the coolers vary so much, according to the size of the distillery, that a general description will by no means apply to them all. When the manufactory is of a moderate size, the coolers are a shallow wooden vessel, covering the floor of an apartment or suit of apartments, placed usually in the upper part of the distillery, and open as much as possible to the influence of the external air. Here the hot worts are pumped up, and left at a depth of one, two, or three inches, till they have acquired the requisite temperature.

When the distillery is on a large scale, it is usual to accelerate the cooling of the worts by agitation. Of late years a new contrivance has been fallen on, which answers much better than the old method, by bringing the worts almost instantly to the particular temperature which the distiller wishes them to acquire. This method is to pass the hot worts through a certain length of tin pipe, which is immersed in a running stream of water. By properly regulating the length of the pipe, the worts may be cooled down either to the temperature of the surrounding water, or to any other intermediate temperature required. As the worts in this case are cooled in close vessels, no evaporation goes on during the process. Hence their strength will not increase during the process, and the quantity will be precisely the same as in the underback, making allowance for the change of temperature. This probably would be a disadvantage to the distillers, while the present law obliges them to brew worts of a given strength. But if this restriction were removed, it would be rather an advantageous circumstance, because it would enable them to regulate the strength of their worts at pleasure, by the quantity of water employed during the mashing and infusion. To the excise officer it would also be a

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convenient circumstance, because it would afford an additional security for determining the strength with accuracy. He would have it in his power to try the strength of the worts while hot in the underback, and when newly let down into the fermenting tuns, before the yeast was added. This second trial ought to give nearly the same result as the first. We say nearly, because, when the worts are hot, it is not so easy to determine their strength with accuracy, as when they are cold.

During the cooling of the wort from raw grain, there is always a considerable deposit of flocky matter, which we conceive consists chiefly, if not entirely, of starch. This flocky matter is swept along with the wort into the fermenting tun. It is the opinion of distillers that it contributes materially to the formation of spirits during the fermentation. We have little doubt that the opinion is well founded. Probably during the fermentation it is converted first into saccharine matter, and then afterwards decomposed into alcohol and carbonic acid.

The temperature to which the wort is cooled before it is let down into the fermenting tuns differs a good deal in different distilleries, and even in the same distillery at different seasons of the year. Winter is the usual season for the distilleries, and it is the season which is considered as most advantageous for conducting the fermentation with success; for it is easy to raise the temperature of the fermenting room to the degree which is considered as best adapted for the process. But when the weather is hotter than that degree, it is a much more difficult matter to keep the fermenting room sufficiently cool. In winter the distillers usually let down the first worts at about 70° ; the second worts are cooled down to 60° or 65° . We do not perceive any good reason for this distinction, though we have frequently seen it practised.

3. The Fermentation.

This is by far the most important part of the whole process. It is by the skill and success with which it is conducted that distillers excel each other. Upon it the profit and loss of the manufactory chiefly turn. Much pains have been bestowed in investigating it; but it is of so capricious a nature as occasionally to thwart the most skilful and experienced brewers. We shall describe the method of proceeding in this process usually followed by the Scotch distillers. In the article BREWING we stated the facts at present known respecting the saccharine matter of the wort and yeast of beer which is employed as a ferment. To that article, therefore, we refer those who wish for information on these subjects.

The yeast employed by the Scottish distillers is chiefly brought from the London porter breweries. Small quantities may be occasionally obtained from breweries in their neighbourhood; but never, we believe, a sufficient quantity to answer their purposes. The best yeast is that which is thrown off the top of the porter during its fermentation. But what is sold by the porter brewers consists chiefly of the slimy matter which remains at the bottom of the vessels when the clear porter is drawn off. Fresh yeast is better than stale; but the distillers being unable to procure a sufficient quantity of fresh yeast for their purposes, are under the necessity of using both fresh and stale.

As the quantity of yeast employed depends upon its quality, it is therefore impossible to lay down any very precise rules upon the subject. For the quantity of wort which we have supposed in the preceding part of this article, a Scotch distiller would probably employ about twenty-seven gallons of good yeast, and about thirty-six gallons if he considered the yeast of inferior quality. Only a portion of this yeast is mixed at first with the wort. The

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remainder is generally added on the second, third, and fourth day. Most commonly, indeed, the whole is added on the third day; but it is customary to make a farther addition at a later period, if the brewer is of opinion that the fermentation is not proceeding so well as it ought to do. We have seen yeast added on the sixth day of the fermentation.

The first portion of yeast mixed with the wort is always if possible fresh yeast, and it is a great object with the distiller to have it of as good a quality as possible. For our wort, the quantity of yeast first used may amount to nine gallons. On the second day nine gallons more may be added, and on the third day nine or eighteen gallons, according to its quality. Some distillers add nine gallons the first day, and twenty-seven the third. Some add nine gallons every day for four days. In short, there is considerable difference, and probably a good deal of caprice, in the practice followed in the various manufactories. At least we have never been able to obtain a satisfactory reason from any brewer why he followed one practice rather than another. In hot weather we should prefer the addition of nine gallons of yeast every day for four days. But in cold weather it would probably answer better to add the whole yeast at twice; and perhaps the third day is the most proper for making the great addition.

The fermentation lasts nine, ten, eleven, or twelve days, according to circumstances. Sometimes, though seldom, we have seen it last thirteen days. During the first five days the fermenting tuns are left open on the top, or only slightly covered; but on the sixth day they are shut up as closely as possible, so as to render the escape of the carbonic acid rather difficult. Two reasons have been alleged for this proceeding. 1. The carbonic acid gas is conceived to carry with it a portion of the alcohol, and by binding down the top it is supposed that the loss by this drain will be diminished. We do not lay much stress on this reason. The fermentation is almost at an end before the tuns are shut down. Of course, almost the whole of the alcohol abstracted by the carbonic acid has been already removed. 2. The presence of carbonic acid is conceived to promote the fermentation. Hence it is supposed that, by preventing that gas from escaping with facility, the attenuation will be greater than it otherwise would be. Perhaps there may be some foundation for this opinion. There is no doubt that carbonic acid gas may be substituted for yeast as a ferment, and that the fermentation of the wort, under such circumstances, will go on pretty well. We have seen the experiment tried by mixing yeast with wort in a close barrel, from which there proceeded a tin pipe that passed through another barrel filled with wort, and opened at the bottom of it. The gas was absorbed by the wort in this second barrel, and the wort was fermented by it. But the fermentation, as might have been expected, was not so complete as if it had been produced by the usual addition of yeast. The distillers do not collect any yeast from their fermenting vats, but beat it all into the liquid, being of opinion that any such collection would render the fermentation less complete, and, of course, diminish the proportion of spirits obtained.

The wort most commonly increases in temperature from 20° to 25° of the thermometer. Supposing it let down into the fermenting tun at 57°, its temperature, when at the highest, may amount to from 78° to 82°. It usually acquires the highest temperature on the fourth day of the fermentation, frequently upon the fifth day; sometimes upon the sixth, the third, or the seventh day; and we have seen it as late as the eighth, or even the eleventh day, before its temperature became a maximum.

The following table exhibits the number of cases on which the highest temperature took place in these respec-

tive days in seventy-six brewings, conducted upon a pretty large scale:

4th day.....	31 times
5th day.....	23
6th day.....	9
3d day.....	6
7th day.....	5
8th day.....	1
11th day.....	1

This diversity, no doubt, depends upon the goodness of the yeast employed; and, as we have no good criterion by which to determine the exact value of yeast as a ferment, it is impossible to be able to foretell the exact result in any particular case. Indeed we consider the uncertainty of the value of yeast as the great difficulty which the distiller has to encounter. Any person who could discover a method of estimating the exact value of any particular yeast as a ferment would greatly improve this difficult manufactory. We do not believe that such a discovery is impossible. Perhaps the specific gravity of the yeast, or the quantity of solid matter which is left behind when a given weight of the yeast is evaporated to dryness, might furnish very material information. We are rather surprised that no distiller has thought of subjecting yeast to a series of experiments, with a view to ascertain its real value as a ferment. The new information which he would acquire would more than compensate for the trouble, and would probably give him the means of improving his manufactory, or at least of forming some notion of the value of the yeast which he purchases.

As the fermentation proceeds, the specific gravity of the wort diminishes, owing to the decomposition of the saccharine matter, and its conversion into alcohol and carbonic acid. This diminution of specific gravity is called *attenuation* by distillers, and is employed by them as the measure of the success of the fermentation. They can easily foretell the quantity of spirits which their *wash* (the name by which their fermented wort is distinguished) will yield, if they know the attenuation which has taken place during the fermentation. This diminution of specific gravity is produced by two causes. 1. The destruction of the saccharine matter previously dissolved in the liquid, and which occasioned its specific gravity to be greater than that of water. If the whole of this saccharine matter were decomposed, it is obvious that the change of specific gravity from this cause would be exactly such as would sink the wash to the specific gravity of water. 2. The second cause of the diminished specific gravity of the fermented wort is the formation of a quantity of alcohol, which, being lighter than water, occasions, by its evolution, a corresponding diminution of the specific gravity of the liquid. The specific gravity of the purest alcohol which it has been hitherto possible to obtain, is 0.793 at the temperature of 60°. When mixed with water it enters into a chemical combination with that liquid. Hence the specific gravity is greater than the mean of that of the water and alcohol, though considerably less than that of water. It is obvious, if we were to add alcohol to the unfermented wort, we would diminish its specific gravity. We might even, by this means, render it as light, or even lighter, than water, though none of the saccharine matter were destroyed. It is obviously impossible, therefore, to determine how much saccharine matter has been decomposed by the fermentation from the attenuation alone. Suppose the original specific gravity of the wort to have been 1.060; and suppose that, after the fermentation, its specific gravity is reduced to 1.002. The first of these specific gravities indicates 55.8 lbs. of saccharine matter per barrel; the second 1.6 lbs. per barrel. It does not follow, as the distillers suppose, that 54.2 lbs. of saccharine mat-

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ter per barrel have been decomposed and converted into alcohol and carbonic acid. A considerable portion of the saccharine matter still remains undecomposed, but the alcohol which has been formed counteracts the specific gravity of this saccharine matter, and prevents its presence from being correctly indicated by the saccharometer. But if we measure out a quantity of such wash, put it into a retort or still, and distil off about a third of it; if we then take the residual wash which remains in the retort or still, and add pure water to it till its original bulk be restored, the saccharometer being applied to it will indicate the quantity of saccharine matter which it still contains; and this quantity being subtracted from the original quantity of saccharine matter contained in the wort before the fermentation commenced, the remainder will be the saccharine matter decomposed by the process.

Alcohol is a substance which has a tendency to stop fermentation, and it stops that process completely when added to fermenting wort in sufficient quantity. It must be obvious from this, that very strong worts are injurious to the profits of the distiller; because the stronger the wort the greater will be the proportion of alcohol evolved, and, of course, the fermentation will ultimately be impeded or stopped altogether, before the whole saccharine matter is decomposed. Accordingly, the *spent wash* will always be found to contain a considerable proportion of saccharine matter, and it might be fermented again, and made to yield no inconsiderable quantity of spirit. The writer of this article made nine trials with malt worts, which were designedly made weak. They were fermented as thoroughly as possible, and the following table indicates the specific gravities to which they were reduced. The original specific gravity probably did not much exceed 1.045.

Sp. Gravity.

1.....	1.0012
2.....	1.0045
3.....	1.0018
4.....	1.0000
5.....	1.0012
6.....	1.0045
7.....	1.0047
8.....	1.0007
9.....	1.0007

Upon examining the state of the wash after the fermentation was at an end, we found that 4.34 parts of the saccharine matter had been decomposed, and that one part remained unaltered. So that in these nine experiments, which were as favourable as possible to the fermentation, on account of the weakness of the worts, not much less than one fifth of the whole saccharine matter remained unaltered. Surely then we may lay it down as a fact, that, in all cases of fermentation in a Scotch distillery, at least one fifth of the whole saccharine matter is prevented from being decomposed by the antifermenting power of the alcohol evolved. The consideration of this circumstance renders it of more importance to allow the distiller to make his wort weak; for the weaker the original wort, the less will the quantity be of the saccharine matter which is prevented from being decomposed by the presence of the alcohol evolved.

When the heat has acquired its maximum, we may reckon, at an average, that nine tenths of the whole attenuation has been completed. No judgment can be formed of the ultimate attenuation, by the rapidity or slowness with which the heat reaches its maximum. We have seen the attenuation equally good when the maximum temperature happened on the third, fourth, fifth, or sixth day.

It is impossible to lay down any specific rule with respect to the length that attenuation ought to be carried. The object of the distiller is to render his wash, if possi-

ble at least, as light as water. This object they frequently accomplish. But it sometimes happens that the fermentation stops when the specific gravity has sunk to 1.013 or 1.008, and no addition of yeast will make it sink lower. Bad yeast is the most probable reason of this ill success. If the wash be allowed to remain in the fermenting tuns after the fermentation is at an end, its specific gravity will be found gradually to increase a little, and it will not yield so great a proportion of spirits. This is owing to the formation of vinegar in the wash, which takes place at the expense of the alcohol; and if the vinegar-forming process were allowed to go on long enough, the alcohol would disappear altogether.

Distillers always ferment their worts in tuns of a large size. This is attended with the advantage, that the artificial heat evolved by the fermentation is not so speedily dissipated as it would be if the process were conducted in small vessels. Some distillers fill the tuns only partly, leaving a portion of the upper part empty, that it may contain the froth formed when the wort is in full fermentation. Others fill the tuns almost to the top, and cover down the mouth with a lid, from which a tube passes to an open vessel placed above the tun. When the liquid swells by the fermentation, it passes up the tube into the open vessel, and runs down again when the fermenting process subsides. No regular set of experiments, that we know of, has been made to determine which of these two methods is the best.

We have already observed that every 9.2 lbs. of saccharine matter really decomposed by the fermenting process yield a gallon of spirits one to ten over hydrometer proof, or of the specific gravity 0.90917 (at the temperature of 60°). But as the distillers are not in possession of a good method of determining how much saccharine matter has been decomposed, the easiest rule will be to allow 11½ lbs. of saccharine matter, estimated before the fermentation begins, to yield a gallon of spirits at 0.90917 specific gravity. If the original worts be very weak, perhaps we might take 11 lbs. of saccharine matter as producing that quantity of spirits; but while the present law respecting the strength of the worts continues, 11½ lbs. will be found, upon an average, to come very near the truth.

It does not seem to be possible to ferment wort from a mixture of raw grain and malt as completely as is required for the purposes of the distiller, without its becoming sour. There seems no reason to doubt that the acid formed is the acetic. Some are of opinion that the presence of this acid contributes to improve the flavour of the spirits. But the quantity of acetic acid usually present in wash is so small, that we do not see any reason for supposing that it can produce any sensible effect. It is important, therefore, that the acidity should be as small as possible, because the acid is formed at the expense of the alcohol in the wash. Hence the wash ought to be distilled as soon as the fermentation has come to a conclusion.

4. The Distilling.

The stills commonly used in other countries are of large dimension, and very deep, so that a great deal of time is necessary to finish one process. Once in the week, for example, is no uncommon period. The same kind of still was used in Scotland till about the year 1787, when the duty began to be levied on the distillers by a license paid at the commencement of the season upon every still according to its capacity. This was done to prevent that propensity to smuggling by which the generality of Scotch distillers were supposed to be actuated. The quantity of spirits which a still of given dimensions could produce in a year was calculated, and the license was laid on according to it. This saved the excise-officers all farther trouble,

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after gauging the stills and collecting the license-duty, excepting an occasional visit to be certain that no new still of larger dimensions was substituted for the old one. But about the year 1788 Messrs John and William Sligo, at that time rectifiers in Leith, made an important alteration in the shape of the still, at the suggestion of an Englishman, which greatly increased the rapidity of distillation. They diminished their height, and increased the diameter of their bottom. The consequence of this alteration was, that they were able to distil off the contents of the still in a few hours, instead of once a week, as had formerly been the practice. Thus they were enabled to produce a great quantity of spirits from a very small still, and, of course, paid in reality a much smaller duty than their brother manufacturers. This lucrative improvement they possessed exclusively for about a year; but a secret of such importance could not be long confined to a single house. It became gradually known to other distillers, and was soon imitated by all. The license-duty was increased year after year; but the ingenuity of the distillers enabled them to outstrip the acts of parliament; till, at last, a committee of the House of Commons was appointed to investigate the subject in 1799. A very bulky report was published by this committee, which contains a vast collection of curious facts respecting the mode of distillation at that time practised in Scotland. The license, in consequence of this report, was laid on the distiller, on the supposition that he could discharge his still every eight minutes, during the whole season that the manufactory was in activity. Since that time the time of discharging the still was considerably shortened. But the saving in point of time was attended with such an enormous waste of fuel, that it is rather doubtful whether it was attended with much additional profit to the distiller. In the year 1815, which was the last year of the license-duty, a still capable of holding 80 gallons could be completely distilled off, emptied, and ready for a new operation in $3\frac{1}{2}$ minutes, or even, it is said, in some cases in 3 minutes; and a still of 40 gallons in $2\frac{1}{2}$ minutes. At that time a change took place in the excise laws; the license-duty was abolished, and the whole duty was levied, as in England, on the wash and the spirits produced. There was, of course, no longer any necessity for continuing the rapid mode of distillation; and, as it was attended with a very considerable waste of fuel, and was in other respects much more expensive than the slow process, it has been, of course, discontinued. We conceive, however, that it will be worth while to give a short description of the still and furnace which the Scotch distillers employed during the existence of the license-duty. It would be a great pity indeed to allow the results of such a series of important experiments to be forgotten.

The stills were made of copper. Those capable of holding 44 gallons were about 44 inches in diameter at the bottom, and about 5 inches deep. Those capable of holding 80 gallons were 54 inches in diameter, and about 8 inches deep. The bottom was perfectly flat, and about three eighths of an inch thick. Within it there were a number of iron chains, which were turned round by machinery, and rubbing against the bottom prevented the thick matter, which the wash always contains, from adhering to the bottom of the still and catching fire. This would have almost immediately occasioned the destruction of the still; and the scorched starchy matter would have communicated a disagreeable flavour to the spirits, which could not have been got rid of afterwards. There was likewise a circular plate in the inside of the still, towards its top. The use of it was to break the bubbles that rise during rapid distillation; and, of course, lessen the risk of the still boiling over, or *running foul* as the distillers term it; and, consequently, the distiller was enabled to put

a greater charge of wash into the still than it would have been in his power to do if the plate had been omitted.

These stills were supported by resting an inch and a half on the brick work all round the bulge. The furnace was quite level, and was placed at the distance of 15 inches below the bottom of the still. The inner end of the grating bars was placed 15 inches within a line falling vertically from the part of support of the bulge of the still. The bars were in two lengths, the inner length was 21 inches, the outer 30 inches, supported by a cross bar between them four inches square. In front of the bars was a dumb plate 10 inches broad. The bottom of the ash-pit was three feet below the grating bars, and on a level with the floor of the distillery. The bars were two inches thick, three inches deep, and three fourths of an inch apart. The brick work extended 21 inches beyond the dumb plate, and was four feet wide and four inches higher outside than at the bulge of the still. The furnace doors were 30 inches wide. The bottom of the furnace beyond the grating bars was lined with fire-brick nine inches deep, and passed level backward into the chimney.

The chimney was 60 feet high, four feet square within from top to bottom, and consisted of a double wall. The inner wall of fire-bricks was nine inches thick. The outer wall was placed at three inches distance on all sides from the inner wall, and the space was left open at the top. The outer wall was 18 inches thick at bottom, diminishing regularly on the outside till reduced to nine inches at top. The two walls were tied together, at certain distances, by long fire-bricks. This separation of the two walls was found to prevent the rapid destruction of the chimney from the intensity of the fire, which always happened when the two walls were in contact.

Such was the construction of the furnace and the shape of the stills during the time that rapid distillation was practised in Scotland, when both had been brought to the greatest degree of perfection which the distillers were capable of giving them. The writer of this article has not had an opportunity of seeing the shape of the stills used by the Scotch distillers since the license-duty was abolished. But it is probable that the old shape will not have been entirely restored; but that the present stills, though much larger in size, imitate the late stills in the great diameter of their bottom, and their comparative shortness when compared with the stills employed by the English distillers.

The top of the still ends in a kind of tube, which is bent downwards, and connected with a tin tube, which makes a number of revolutions in a large vessel filled with cold water, and therefore called the worm. This large vessel is called the *refrigeratory*, and care is taken to keep the water in it always cool by means of a stream of water which is constantly flowing into it. The wash being put into the still, and the top being fixed down, heat is applied to the vessel till it is made to boil. The spirits being more volatile than the water, pass over first in the state of steam, and are condensed into a liquid as they pass through the worm. The first portions that come over are very strong; but the strength diminishes as the process proceeds. The distiller continues the distillation till the liquid which flows from the worm is as heavy as water, or at least so nearly so that the quantity of spirits remaining is not considered as a compensation for continuing the process any longer. The strength of the liquid proceeding from the worm is ascertained by a small hydrometer, with which it is tried every now and then; and whenever a certain mark on the instrument comes to coincide with the surface of the liquid, a cock at the bottom of the still is opened, and what remains in the still is let off. This liquor is called the *spent wash*. It is a muddy brown liquid, still containing a quantity of undecomposed saccha-

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Distillation. rine matter. It is therefore used as food for cattle. These animals are fond of it, and soon fatten upon it.

To prevent the still from boiling over, which is apt to happen towards the commencement of the distillation, it is usual to throw a piece of soap into the vessel along with the wash. This substance is partly decomposed, and the oily matter which it contains spreading on the surface, forms a thin coat, which breaks the large bubbles when they reach it, and thus prevents the wash from swelling beyond the requisite bulk. Butter would answer equally well with soap, and would be less apt to give a disagreeable flavour to the spirits; but its high price prevents the possibility of using it for that purpose. We have some suspicion that hogs' lard would answer. If it were found to do so, it would be cheaper than soap, and less apt to give a bad flavour to the spirits. The supposition, however, that soap communicates a disagreeable flavour to spirits, though very generally entertained, is, we believe, a mistake. We have certainly met with spirits distinctly tainted with soap, and having in consequence a highly nauseous taste. But this was at a time when the rapid mode of distilling was only on its progress to perfection, and was owing, we believe, to little bits of the soap having been accidentally forced into the worm, and afterwards dissolved by the spirits.

It is impossible to lay down any rule with respect to the strength of the weak spirit obtained by this first distillation, and which is called *low wines* in Scotland. That strength must depend partly upon the original strength of the wort, partly on the attenuation which has taken place during the fermentation, but chiefly upon the attention of the distiller to distil off the whole of the spirituous portion of the wash. In a great number of cases in which we have had the curiosity to determine the strength of the low wines in distilleries, we have found the specific gravity at 60°, differing but little from 0.978; frequently a little weaker, and very rarely a little stronger. Low wines of this strength contain the fifth part of their weight of alcohol of the specific gravity 0.825; the remaining four fifths are water.

The low wines are put into the still and subjected to a second distillation, which in Scotland is called *doubling*. The first portion which comes over is a milky liquid, known by the name of *foreshot*. Its taste is disagreeable, and on that account it is received by itself, and returned back into the low wines to be subjected to another distillation. The properties of the foreshot are owing to an oil with which it is loaded. When the spirits begin to run transparent from the end of the worm, they are allowed to run into a receiver prepared for them. Whenever their specific gravity, determined by the hydrometer, has reached a certain point, they are no longer allowed to flow into the receiver containing the spirits, but into a place by themselves, and the distillation is continued till the liquid coming over has approached very nearly to the specific gravity of water. This third portion is called *faints*. It is mixed with the low wines and distilled again. Thus the distillation of the low wines is continued till the whole of their alcoholic part is brought to that degree of strength which fits them for the market. The strength at which the duty is levied on them is one to ten above hydrometer proof, which corresponds with the specific gravity 0.90917. They are prohibited from sending out of their manufactory spirits of greater strength than this, or of a strength under one in six below proof, or of the specific gravity 0.9385. Between these two intervals the specific gravity of their spirits may be considered as vibrating; for it is not to be expected that they should be able always to produce spirits of exactly the same specific gravity. We have found the spirits, as obtained by doubling,

of a specific gravity as low as 0.908, and as high as 0.925. No doubt they might be obtained much stronger or much weaker than these two extremes, if there were any object in view to induce the distiller to alter his usual practice.

Such is the mode followed in Scotland in order to obtain whisky. The distillers are at pains to purchase the best English barley which they can procure. They are certainly in the right to select English barley for malting; for English barley, when malted, yields more spirits than in the state of raw grain. But for that portion of grain which they use in the distilleries without malting, it would be their interest to employ the best big which they can procure; for good big, while in the state of raw grain, yields rather more spirits than an equal quantity of the best English barley; and as it can be purchased at a cheaper rate than barley, it could obviously be employed with economy as a substitute for that grain. Big is greatly deteriorated by malting it; of course it would be improper to employ it in distilleries in that way; but the distillers might employ it in the state of raw grain with great advantage.

CHAP. II.—OF THE MODE OF MANUFACTURING OTHER KINDS OF SPIRITS.

In this chapter we shall merely make a few very short observations on the processes followed by the distillers in other countries.

1. *Dutch Geneva.*

The Dutch have long been famous for the manufacture of an excellent kind of spirits, known in Scotland by the name of *Gin*, in England by the name of *Hollands*, and sometimes by the name of *Geneva*. We have been told that the manufacture of it originated in the city of Geneva, and that this was the origin of the name Geneva, still applied to it in commerce; but we have no means of determining how far this statement may be depended on. We have not seen in print any accurate account of the mode of making Geneva practised by the Dutch; but the following account may, we believe, be relied on. We are indebted for it to a friend, who about forty years ago went over to Holland on purpose to make himself acquainted with the process. His object was to establish a similar manufactory in Scotland. But the severe laws by which the Scotch distillers were soon after bound put it out of his power to execute his plan.

112 lbs. of barley malt, and 228 lbs. of rye-meal, are mashed together with 460 gallons of water of the temperature 162°. After the infusion has stood a sufficient time, cold water is added till the strength of the wort is reduced to 45 lbs. per barrel. The whole is then put into a fermenting back, at the temperature of 80°. The vessel is capable of holding about 500 gallons. Half a gallon of yeast is added. The temperature rises to 90°, and the fermentation is over in forty-eight hours. The attenuation is such that the strength of the wash is not reduced lower than 12 or 15 lbs. per barrel. The wash is put into the still with the grains and all. The low wines, as usual, are distilled again, and the spirits of the second distillation are rectified; so that the Hollands pass thrice through the still. A few juniper berries and some hops are used to communicate a peculiar flavour to the spirits.

Now, 45 lbs. per barrel constitute a wort so weak that it will not yield above seven and a half per cent. of spirits of the usual strength; so that the produce which the Dutch obtain from their wort cannot amount to much more than half what the Scotch distillers are obliged to produce from theirs.

It is obvious, from the preceding account, that the fer-

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mentation is very imperfectly accomplished in the Dutch process. The small quantity of yeast employed, and the short time that the wort is allowed to ferment, necessarily imply imperfection in the fermentation. And this is obviously the case, for the original strength of 45 lbs. per barrel is only reduced to 15 lbs. per barrel. We have often seen the attenuation of the porter in the London breweries not much less complete. What advantage is gained by putting the grains into the still along with the wash we have not the means of determining. Such a practice can only be followed in distilleries upon a very small scale. We do not see how it could be practised in the Scotch distilleries. Indeed, we have no doubt whatever, that when the mashing is repeated a sufficient number of times, and the grains sufficiently washed with hot water, every thing likely to contribute to the formation of spirits will be carried off.

Every person acquainted with the flavour of Hollands and Lowland whisky, must admit that the former is greatly superior to the latter. Indeed the flavour of Hollands is equal to that of malt whisky. This is owing in part to the small proportion of raw grain used by the Dutch distillers. 112 lbs. of barley malt may be reckoned at three bushels. We do not know the average weight of a bushel of rye; but if we suppose it to be 50 lbs. 228 lbs. will amount to about $4\frac{1}{2}$ bushels; so that, in the Dutch distilleries, the malt bears to the raw grain the proportion of two to three. We suspect that another reason of the superiority of the Dutch spirit over the Scotch, is the small quantity of yeast employed by the manufacturers of Hollands. The vast quantity of porter yeast used by the Scotch distillers, often in a state almost approaching to putrefaction, cannot but have an injurious effect upon the flavour of their spirits, and has undoubtedly contributed to the superior reputation of Highland over Lowland whisky; for the Highland distillers (especially the smugglers) have not the means of procuring yeast from London. Of course their wash is less perfectly fermented, but the flavour of their spirits is much more agreeable. We think, indeed, that the flavour communicated by the yeast to Scotch Lowland whisky may be distinctly perceived, and on that account are disposed to suspect that the flavour of the spirits always suffers in proportion as the fermentation is brought nearer a state of perfection. Any person who should find out a method of fermenting wort without the necessity of employing such quantities of porter yeast as the distillers use, would undoubtedly prodigiously improve the flavour of the spirits manufactured by the Scotch distillers. If government were to make such an alteration in the laws as would enable the distiller to employ a greater proportion of malt without any material increase of expense, the object might be considered as accomplished. In the present state of the manufactures of Great Britain, it would be impossible to confer a greater favour on the country than a thorough revision of the excise laws, under the auspices of a set of individuals at once intimately acquainted with the most improved state of chemical science, and with the most liberal principles of political economy. Every thing that improves the quality and diminishes the price of our manufactures is of more value to the country than our legislators seem to be aware of.

We do not think that Hollands could be manufactured in Great Britain with any probability of success. The experiment was tried at Maidstone, in Kent, by a Mr Bishop, who had interest enough with Mr Pitt to get a special clause introduced into an act of parliament permitting him to manufacture Hollands according to the Dutch method; but the manufactory was never successful. The Maidstone Hollands never acquired much repu-

tation. The distillery languished for some years, and then terminated in a bankruptcy. Some attempts have been lately made to revive the Maidstone establishment; but we may venture to predict that they will not be successful.

2. Rum.

This is the name given to a spirit manufactured in the West India islands, from the molasses, &c. which remain after the sugar is separated in small crystals from the boiled juice of the sugar cane. We do not know any thing about the origin of the word *rum*, or the time at which the manufacture of this spirit commenced; not, probably, till after the West Indies were colonized by Europeans. At present it is chiefly in the islands belonging to Great Britain that this spirit is made. The process, as we obtained it from a Dominica planter, who had for many years been in the habit of making this spirit, is as follows:

Twelve parts of sweets are dissolved in 100 parts of water, and fermented as completely as possible by means of yeast, which is chiefly obtained in the distillery itself by means of the fermentation of the rum wort, which gradually generates it. Fourteen gallons of spirits, one to ten over proof, are obtained from 100 gallons of wash. If this statement be correct, the produce of spirit from molasses exceeds considerably what can be obtained in this country from barley. A solution of 12 parts of sugar in 100 of water would make a wort containing about 44 lbs. of saccharine matter per barrel; from 100 gallons of which, in this country, we would not obtain more than 8 gallons of spirits of the above strength; but we suspect some mistake on the part of our informer, as he communicated the process to us in this country several years after he had given over the actual superintendence of his rum distillery.

The peculiar flavour which distinguishes rum, and makes it so agreeable to the taste, is undoubtedly owing to a peculiar oil contained in the sugar-cane; for when spirits are made in this country from sugar, they are entirely destitute of the peculiar flavour of rum, and resemble, in their properties, the common spirit made in this country from barley. The colour of rum is derived from the oak casks in which it comes to this country from the islands in which it is made.

CHAP. III.—ON THE NATURE OF THE VINOUS FERMENTATION.

In the article BREWING we have given a short sketch of the facts hitherto ascertained respecting the nature of the change which saccharine matter undergoes when fermented; and we have very little to add to the facts stated in that article. We shall merely enter a little more minutely into the detail of facts than we thought necessary under the article BREWING.

Common sugar has been analysed by Gay-Lussac and Thenard, by Berzelius, and by Dr Prout. The method followed by each differed a little from that of the others, and the results, though they do not quite tally, certainly approach considerably to each other. The following table exhibits the composition of 100 parts of sugar, according to each of these chemists:

	Gay-Lussac and Thenard.	Berzelius.	Prout.
Oxygen	50.63.....	49.083.....	53.33
Carbon	42.47.....	44.115.....	39.99
Hydrogen.....	6.90.....	6.802.....	6.66
	100.00	100.000	99.99

To be able to determine from these analyses the number of atoms of oxygen, carbon, and hydrogen, which are

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requisite to form a constituent particle of sugar, it would be requisite, in the first place, to be able to specify the weight of sugar capable of neutralizing a given weight of any solifiable base. Berzelius found, that when a solution of a given weight of sugar in water was digested over oxide of lead, the oxide was at first dissolved; but, after a certain interval of time, a light white powder makes its appearance. This powder is a compound of sugar and oxide of lead, and is composed, according to Berzelius's analysis, of

Sugar.....	41.74.....	10.03
Oxide of lead.....	58.26.....	14
	100.00	

Now the equivalent number for oxide of lead is 14. It follows from this, that if the white powder be a compound of an atom of sugar and an atom of oxide of lead, the weight of an atom of sugar is 10. But we have no evidence whatever for adopting one atom of sugar in this compound rather than two. And as one atom will not accord with the phenomena of fermentation, it is better to consider the white powder as a compound of one atom oxide of lead and two atoms of sugar. On that supposition an atom of sugar will weigh about five. Now, if we suppose it to be composed of

3 atoms oxygen.....	= 3.
3 atoms carbon.....	= 2.25
3 atoms hydrogen.....	= 0.375
	5.625

the weight of an atom of sugar will be 5.625, which does not differ very much from the weight, as resulting from Berzelius's analysis; not more, indeed, than might be expected from the extreme difficulty of analysing such a compound with precision. But if we suppose the weight of an atom of sugar to be as now stated, 100 parts of it will be composed of

Oxygen.....	= 53.31
Carbon.....	= 40.03
Hydrogen.....	= 6.66
	100.00

Now, as these numbers are almost exactly the same with those of Dr Prout, we are disposed to consider them as representing the true constituents of sugar.

From the phenomena of fermentation, as described under the present article, and in the article BREWING, it ap-

DISTINCTION, in *Logic*, is an assemblage of two or more words, by means of which disparate things or their conceptions are denoted.

DISTORTION, in *Medicine*, is when any part of the human body remarkably deviates from its natural shape or position. Distortions of different parts may arise either from a convulsion or a palsy; though sometimes distortion in the shape of the whole body has arisen merely from carelessness and ill habits.

DISTRESS, in its ordinary acceptation, denotes calamity, misery, or suffering.

The Contemplation of DISTRESS a source of pleasure. On this subject there is a very pleasing and ingenious essay by Dr Barnes, in the *Memoirs of the Literary and Philosophical Society of Manchester*. It is introduced with the following motto from Lucretius:

Suave mari magno, turbantibus æquora ventis,
E terrâ alterius magnum spectare periculum.
Non quia vexari quæquam est jucunda voluptas;
Sed quibus ipse malis careas, quia cernere suave est.

pears that by the fermentation the sugar is decomposed and converted into alcohol and carbonic acid. Alcohol, according to the analysis of Theodore de Saussure, is composed of three atoms hydrogen, two atoms carbon, and one atom oxygen. Carbonic acid is composed of two atoms oxygen and one atom carbon. Hence the weight of an integrant particle of alcohol is 2.875. For

1 atom oxygen.....	= 1
2 atoms carbon.....	= 1.5
3 atoms hydrogen.....	= 0.375
	2.875

And an integrant particle of carbonic acid weighs 2.75.

We see likewise that a particle of sugar is capable of being decomposed into an integrant particle of alcohol and an integrant particle of carbonic acid. For a particle of alcohol is composed of

	Oxygen.	Carbon.	Hydrogen.
	1 atom	+ 2 atoms	+ 3 atoms
Carbonic acid, of...	2	+ 1	+ 0
	3	+ 3	+ 3

both together, we see, corresponding to the number of atoms in a particle of sugar.

If fermentation then be merely the separation of sugar into an atom of alcohol and an atom of carbonic acid, there ought to be formed,

Of alcohol.....	2.875
Of carbonic acid.....	2.75

But alcohol of 0.825 contains about the fifth of its weight of water. Hence by fermentation sugar is converted into

Alcohol of 0.825	3.45 parts, or 55.6
Carbonic acid gas	2.75 44.4
	6.20 100.0

Now these proportions approach very nearly the results obtained by Lavoisier and Thenard. We are disposed therefore to consider the explanation which we have given as likely to be the true one.

In what way the yeast acts, if no portion of it enter into the composition of the alcohol or carbonic acid, as would appear from what we know of the subject, we have no means at present of forming a conception. It would be requisite, before we could reason on the subject, to be better acquainted with the composition of yeast than we are at present. (L.)

"The pleasure here described by the poet, and of which he has mentioned so striking and apposite an instance, may perhaps at first seem of so singular and astonishing a nature, that some may be disposed to doubt of its existence. But that it does exist in the case here referred to, and in many others of a similar kind, is an undoubted fact; and it may not appear an useless or disagreeable entertainment to trace its source in the human breast, together with the final cause for which it was implanted there by our benevolent Creator.

"Shall I, it may be said, feel complacency in beholding a scene in which many of my fellow-creatures are agonizing with terror, whilst I can neither diminish their danger, nor, by my sympathy, divide their anguish? At the sight of another's woe, does not my bosom naturally feel pain? Do I not share in his sensations? And is not this strong and exquisite sensibility intended by my Maker to urge me on to active and immediate assistance? These sensations are indeed attended with a noble pleasure, when I can, by friendly attention, or by benevolent communica-

Distress. tion, soothe the sorrows of the poor mourner, snatch him from impending danger, or supply his pressing wants. But in general, where my sympathy is of no avail to the wretched sufferer, I fly from the spectacle of his misery, unable or unwilling to endure a pain which is not allayed by the sweet satisfaction of doing good."

In answer to these objections, it will be necessary, in the first place to prove the reality of the feeling, the cause of which, in the human constitution, many have attempted to explore.

Mr Addison, in his beautiful papers on the pleasures of the imagination, has observed, "that objects or scenes, which, when real, give disgust or pain, in description often become beautiful and agreeable. Thus, even a dunghill may, by the charms of poetic imagery, excite pleasure and entertainment. Scenes of this nature, dignified by apt and striking description, we regard with something of the same feelings with which we look upon a dead monster.

.....Informe cadaver
Protrahitur: nequeunt expleri corda tuendo
Terribiles oculos, vultum, villosaque setis
Pectora semiferi, atque extinctos faucibus ignes.

"This," he observes, "is more particularly the case where the description raises a ferment in the mind, and works with violence upon the passions. One would wonder," he adds, "how it comes to pass, that passions, which are very unpleasant at all other times, are very agreeable when excited by proper description; such as terror, dejection, grief, &c. This pleasure arises from the reflection we make upon ourselves, whilst reading it, that we are not in danger from them. When we read of wounds, death, &c. our pleasure does not rise so properly from the grief which these melancholy descriptions give us, as from the secret comparison we make of ourselves with those who suffer. We should not feel the same kind of pleasure if we actually saw a person lying under the tortures that we meet with in a description."

And yet, upon the principle assigned by this amiable writer, we might feel the same, or even higher pleasure, from the actual view of distress, than from any description; because the comparison of ourselves with the sufferer would be more vivid, and consequently the feeling more intense. We would only observe, that the cause which he assigns for this pleasure is the very same with that assigned by Lucretius in our motto. Mr Addison applies it to the description, the poet to the actual contemplation, of affecting scenes. In both, the pleasure is supposed to originate in selfishness. But wherever the social passions are deeply interested, as they are here supposed to be, from the pathetic description, or the still more pathetic survey, of the sufferings of another, the sympathetic feelings will of themselves at once, and previously to all reflection, become a source of agreeable and tender emotions. They will thus dignify and enhance the satisfaction, if any such be felt, arising merely from the consideration of our own personal security. And the more entirely we enter into the scene, by losing all ideas of its being either past or fabulous—the more perfectly we forget ourselves, and are absorbed in the feeling—the more exquisite is the sensation.

But as our subsequent speculations will chiefly turn upon the pleasure derived from real scenes of calamity, and not from those which are imaginary, we may be expected to produce instances in proof of the proposition that such pleasure is actually felt by persons very different in their tastes and mental cultivation.

We shall not mention the horrid joy with which the savage feasts his eyes upon the agonies and contortions of

his dying prisoner, expiring in all the pains which artificial cruelty can inflict. Nor will we recur to the almost equally savage sons of ancient Rome, when the majesty of the Roman people could rush with eagerness and transport to behold hundreds of gladiators contending in fatal conflict, and probably more than half the number extended, weltering in blood and writhing in agony upon the arena. Nor will we mention the Spanish bull feasts; nor the fervent acclamations of an English mob around their fellow-creatures when engaged in furious battle, in which it is possible that some of the combatants may receive a mortal blow, and be hurried into another world. Let us survey the multitudes which in every part of the kingdom always attend an execution. It may perhaps be said, that in every place the vulgar have little of the sensibility and tenderness of more polished minds. But in the last-mentioned instance, an execution, there is no exultation in the sufferings of the poor criminal. He is regarded by every spectator with the most melting compassion. The whole assembly sympathize with him in his unhappy situation; an awful stillness prevails at the dreadful moment; many are wrung with unutterable sensations; and prayer and silence declare, more loudly than any language could, the interest they feel in his distress. Should a reprieve come to rescue him from death, how great is the general triumph and congratulation. And probably in this multitude you will find not the mere vulgar herd alone, but men of superior knowledge and of more refined sensibility, who, led by some strong principle which we wish to explain, feel a pleasure greater than all the pain, great and exquisite as one should imagine it to be, in beholding such a spectacle.

The man who condemns many of the scenes we have already mentioned as barbarous and shocking, would probably run with the greatest eagerness to some high cliff overhanging the ocean, to see it swelled into a tempest, though a poor vessel, or even a fleet of vessels, were to appear as one part of the dreadful scenery, now lifted to the heavens on the foaming surge, now plunged deep into the fathomless abyss, and now dashed upon the rocks, where they are in a moment shivered into fragments, and, with all their mariners, entombed in the deep. Or, to vary the question a little, who would not be forward to stand safe on the top of some mountain or tower, adjoining to a field of battle, in which two armies meet in desperate conflict, though probably thousands may soon lie before him prostrate on the ground, and the whole field present the most horrid scenes of carnage and desolation? That in all these cases pleasure predominates in the compounded feeling is plain, because you continue to survey the scene; whereas, when pain became the stronger sensation, you would certainly retire.

Cultivation may indeed have produced some minuter differences in the taste and feelings of different minds; and those whose sensibilities have not been refined by education or science, may feel the pleasure in a more gross and brutal form. But do not the most polished natures feel a similar, a kindred pleasure, in the deep-wrought distresses of the well-imagined scene? Here the endeavour is to introduce whatever is dreadful or pathetic, whatever can harrow up the feelings or extort the tear. And the deeper and more tragical the scene becomes, the more it agitates the several passions of terror, grief, or pity, the more intensely it delights even the most polished minds. They seem to enjoy the various and vivid emotions of contending passions. They love to have the tear trembling in the eye, and to feel the whole soul as it were rapt in thrilling sensations. For that moment they seem to forget the fiction; and afterwards commend that exhibition most in which they most entirely lost sight of the

Distress. author and of their own situation, and were alive to all the unutterable vibrations of strong or melting sensibility.

Taking it then for granted, that in the contemplation of many scenes of distress, both imaginary and real, a gratification is felt, let us endeavour to account for it by mentioning some of those principles, interwoven into the web of human nature by its benevolent Creator, on which that gratification depends.

Dr Akenside, in one of the most striking passages of his *Pleasures of the Imagination*, has endeavoured to show that the sympathetic feelings are virtuous, and therefore pleasant; and from the whole he deduces this important conclusion, that every virtuous emotion must be agreeable, and that this is the sanction and the reward of virtue. The thought is amiable, and the conclusion noble; but still the solution appears to us to be imperfect. We have already said, that the pleasure arising from the contemplation of distressful scenes is a compounded feeling arising from several distinct sources in the human breast. The kind and degree of the sensation must depend upon the various blendings of the several ingredients which enter into the composition. The cause assigned by Mr Addison, namely, the sense of our own security, may be supposed to have some share in the mass of feelings. That of Dr Akenside may be allowed to have a still larger proportion. Let us attempt to trace some of the rest.

There are few principles in human nature of more general and important influence than that of sympathy. An ingenious writer, led by the fashionable idea of simplifying all the springs of human nature into one source, has, in his beautiful *Theory of Moral Sentiments*, endeavoured to analyze a very large number of the feelings of the heart into sympathetic vibration. Though it appears to us most probable that the human mind, like the human body, possesses various and distinct springs of action and of happiness, yet he has shown, in an amazing diversity of instances, the operation and importance of this principle of human nature.

We naturally sympathize with the passions of others. But if the passions which they appear to feel be not those of mere distress alone; if, amidst the scenes of calamity, they display fortitude, generosity, and forgiveness; if "rising superior to the cloud of ills which covers them," they stand firm, collected, and patient; a still higher source of pleasure opens upon us, arising from complacent admiration, and that unutterable sympathy which the heart feels with virtuous and heroic minds. By the operation of this principle, we place ourselves in their situation; we feel, as it were, some share of that conscious integrity and peace which they must enjoy. Hence, as was before observed, the pleasure will vary, both as to its nature and degree, according to the scene and characters before us. The shock of contending armies in the field; the ocean wrought to tempest, and covered with the wrecks of shattered vessels; and a worthy family silently yet nobly bearing up against a multitude of surrounding sorrows; will excite very different emotions, because the component parts of the pleasurable sensation consist of very different materials. They all excite admiration; but admiration diversified both as to its degree and its cause. These several ingredients may doubtless be so blended together that the pleasure shall make but a very small part of the mixed sensation. The more agreeable tints may bear little proportion to the terrifying red or the gloomy black.

In many of the instances which have been mentioned, the pleasure must arise chiefly, if not solely, from the circumstances or accompaniments of the scene. The sublime feelings excited by the view of an agitated ocean, relieve and soften those occasioned by the shipwreck: and

the awe excited by the presence of thousands of men, acting as if with one soul, and displaying magnanimity and firmness in the most solemn trial, tempers those sensations of horror and of pain which would arise from a view of the field of battle.

The gratification we are attempting to account for depends also, in a very considerable degree, upon a principle of human nature, implanted in it for the wisest ends; the exercise which it gives to the mind by rousing it to energy and feeling. Nothing is so insupportable as that languor and ennui, for the full expression of which our language does not afford a proper term. To show how agreeable it is to have the soul called forth to exertion and sensibility, we may cite the case of the gamester, who, unable to endure the lassitude and sameness of unanimated luxury, runs with eagerness to the place where probably there await him all the irritation and agony of the most tumultuous passions.

Again, it is a law in our nature, that opposite passions, when felt in succession, and, above all, when felt at the same moment, heighten and increase each other. Ease succeeding pain, certainty after suspense, friendship after aversion, are unspeakably stronger than if they had not been thus contrasted. In this conflict of feelings, the mind rises from passive to active energy. It is roused to intense sensation; and it enjoys that peculiar, exquisite, and complex feeling, in which, as in many articles of our table, the acid and the sweet, the pleasurable and painful pungencies, are so happily mixed together, as to render the united sensation amazingly more strong and delightful.

We have not yet mentioned the principle of curiosity, that busy and active power, which appears so early, continues unimpaired so long, and to which, for the wisest ends, is annexed so great a sense of enjoyment. To this principle, rather than to a love of cruelty, we would ascribe that pleasure which children sometimes seem to feel from torturing flies and lesser animals. They have not yet formed an idea of the pain which they inflict. It is indeed of unspeakable consequence that this practice should be checked as soon and as effectually as possible, because it is so important that they should learn to connect the ideas of pleasure and pain with the motions and actions of the animal creation. And to this principle may we also refer no small share of that pleasure in the contemplation of distressful scenes, the springs of which, in the human heart, we are now endeavouring to unfold.

To curiosity, then, to sympathy, to mental exertion, to the idea of our own security, and to the strong feelings occasioned by viewing the actions and passions of mankind in interesting situations, do we ascribe the gratification which the mind feels from the survey of many scenes of sorrow. We have called it a *pleasure*; but it approaches towards or recedes from pleasure, according to the nature and proportion of the ingredients of which the sensation is composed. In some cases pain predominates; in others there is exquisite enjoyment.

DISTRESS, in *Law*, the seizing or distraining of any thing for rent in arrear, or other duty unperformed.

The effect of this distress is to compel the party either to replevy the things distrained, and contest the taking in an action of trespass against the distrainer; or rather to oblige him to compound and pay the debt or duty for which he was so distrained.

There are likewise compulsory distresses in actions to cause a person to appear in court, of which kind there is a distress personal of one's moveable goods, and the profits of his lands, for contempt in not appearing after summons; and there is likewise real distress of a person's immoveable goods. In these cases none shall be distrained to an-

Distress.

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swer for any thing touching their freeholds, except by the king's writ.

Distress may be either finite or infinite. Finite distress is that which is limited by law, in regard to the number of times it shall be made, in order to bring the party to a trial of the action. Infinite distress is that which is without any limitation, being made till the person appear; it is further applied to jurors who do not appear; as, upon a certificate of assize, the process is *venire facias, habeas corpora*, and distress infinite.

It is also divided into grand distress and ordinary distress. Of these, the former extends to all the goods and chattels which the party has within the county. A person, of common right, may distrain for rents and for all manner of services, and where a rent is reserved on a gift in tail, lease for life, or years, &c. though there be no clause of distress in the grant or lease, so as that he has the reversion; but on a feoffment made in fee, a distress may not be taken, unless it be expressly reserved in the deed.

DISTRIBUTION, in a general sense, the act of dividing a thing into several parts, in order to the disposing each in its proper place.

DISTRIBUTION, in *Architecture*, the dividing and disposing of the several parts and pieces which compose a building, as the plan directs.

DISTRIBUTION, in *Rhetoric*, a kind of description, by which an orderly division and enumeration is made of the principal qualities of the subject. David supplies us with an example of this kind, when, in the heat of his indignation against sinners, he gives a description of their iniquity: "Their throat is an open sepulchre; they flatter with their tongues; the poison of asps is under their lips; their mouth is full of cursing and lies; and their feet are swift to shed blood."

DISTRIBUTION, in *Printing*, the taking a form asunder, separating the letters, and disposing them in the cases again, each in its proper cell.

DISTRICT, in *Geography*, a part of a province, distinguished by peculiar magistrates, or certain privileges; in which sense it is synonymous with hundred.

DISTRINGAS, in *Law*, a writ commanding the sheriff or other officer to distrain a person for debt to the king, &c. or for his appearance at a certain day.

DISTRINGAS *Juratores*, a writ directed to the sheriff, by which he is commanded to distrain upon a jury to appear and to return issues on their lands, &c. for non-appearance. This writ of *distringas juratores* issues for the sheriff to have their bodies in court at the return of the writ.

DITCH, a common fence or inclosure in marshes, or other wet land where there are no hedges.

DITCH, in *Fortification*, called also *fosse* and *moat*, a trench dug round the rampart or wall of a fortified place between the scarp and counterscarp.

DITHYRAMBUS, in ancient poetry, a hymn in honour of Bacchus, full of transport and poetical rage.

This poetry owes its birth to Greece, and to the transports of wine; and yet art is not quite exploded, but delicately applied to guide and restrain the dithyrambic impetuosity, which is indulged only in pleasing flights. Horace and Aristotle tell us that the ancients gave the name of dithyrambus to those verses in which none of the common rules or measures were observed. As we have now no remains of the dithyrambus of the ancients, we cannot say exactly what this measure was.

DITONE, in *Music*, an interval comprehending two tones. The proportion of the sounds which form the ditone is 4 : 5, and that of the semitone is 5 : 6.

DITRIHEDRIA, in *Mineralogy*, an old term expressive of crystals with twice three sides, or six planes, being

formed of two trigonal pyramids joined base to base without any intermediate prism.

DITTFURT, a market-town of the Prussian province of Saxony, situated on the river Bode, with 1797 inhabitants, who cultivate much flax, and conduct some tanneries.

DITTEAH, a town and fortress of Hindustan, in the province of Bundelcund. It is populous and well built, about a mile and a half long, and nearly as much in breadth. The houses are chiefly constructed of stone covered with tiles. It is surrounded by a stone wall, and furnished with gates. Without the town is the rajah's palace, standing on an eminence, and commanding a very extensive prospect, including a handsome lake. It is an ancient place, having been in the rajah's family for several centuries. The surrounding district yields a revenue of between L.12,000 and L.15,000 sterling per annum. On the cession of Bundelcund by the peshwa to the British in 1804, the rajah of Ditteah joined the British standard, and a treaty was concluded with him, by which he was confirmed in the possession of his ancient inheritance. Long. 78. 32. E. Lat. 25. 43. N.

DITTO, in books of accounts, usually written D^o, signifies the afore mentioned. The word is corrupted from the Italian *detto*, the said; as in our law phrase, "the said premises," meaning the same as were afore mentioned.

DITTON, HUMPHRY, an eminent mathematician, was born at Salisbury on the 29th May 1675. Being an only son, his father, observing in him an extraordinary capacity, determined to cultivate it by means of a good education. For this purpose he placed him in a reputable private academy, upon quitting which he at the desire of his father, though against his own inclination, engaged in the profession of divinity, and began to exercise his profession at Tunbridge, in the county of Kent, where he continued to preach some years, during which time he married a lady of that place.

But a weak constitution and the death of his father induced Mr Ditton to quit that profession; and at the persuasion of Dr Harris and Mr Whiston, both eminent mathematicians, he engaged in the study of mathematics, a science to which he had always a strong inclination. In the prosecution of this science he was much encouraged by the success and applause he received, being greatly esteemed by the chief professors of it, and particularly by Sir Isaac Newton, by whose interest and recommendation he was elected master of the new mathematical school in Christ's Hospital, where he continued till his death, which happened in 1715, in the fortieth year of his age.

Mr Ditton published the following mathematical and other tracts: 1. Of the Tangents of Curves, &c. *Phil. Trans.* vol. xxiii. 2. A Treatise on Spherical Catoptrics, published in the *Phil. Trans.* for 1705, from which it was copied and reprinted in the *Acta Eruditorum* 1707, and also in the Memoirs of the Academy of Sciences at Paris. 3. General Laws of Nature and Motion, 8vo, 1705. Wolfius mentions this work, and says that it illustrates and renders easy the writings of Galileo, Huygens, and the *Principia* of Newton. It is also noticed by La Roche, in the *Mémoires de Littérature*, vol. viii. p. 46. 4. An Institution of Fluxions, containing the first Principles, Operations, and Applications of that admirable method, as invented by Sir Isaac Newton, 8vo, 1706. This work, with additions and alterations, was again published by Mr John Clarke in the year 1726. 5. In 1709 he published the *Synopsis Algebraica* of John Alexander, with many additions and corrections. 6. His Treatise on Perspective was published in 1712. In this work he explained the principles of that art mathematically; and, besides teaching the

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methods then generally practised, gave the first hints of the new method afterwards enlarged upon and improved by Dr Brook Taylor, and which was published in the year 1715. 7. In 1714 Mr Ditton published several pieces, both theological and mathematical, particularly his Discourse on the Resurrection of Jesus Christ; and The New Law of Fluids, or a Discourse concerning the Ascent of Liquids, in exact Geometrical Figures, between two nearly contiguous Surfaces. To this was annexed a tract to demonstrate the impossibility of thinking or perception being the result of any combination of the parts of matter and motion; a subject much agitated about that time. To this work also was added an advertisement from him and Mr Whiston concerning a method for discovering the longitude, which it seems they had published about half a year before. This attempt probably cost our author his life; for although it was approved and countenanced by Sir Isaac Newton before it was presented to the Board of Longitude, and the method had been successfully put in practice in finding the longitude between Paris and Vienna, yet that board then determined against it; so that the disappointment, together with some public ridicule, particularly in a poem written by Dean Swift, affected his health so that he died in the ensuing year, 1715.

In an account of Mr Ditton, prefixed to the German translation of his Discourse on the Resurrection, it is said that he had published, in his own name only, another method for finding the longitude, but which Mr Whiston denied. However, Raphael Levi, a learned Jew, who had studied under Leibnitz, informed the German editor that he well knew that Ditton and Leibnitz had corresponded upon the subject, and that Ditton had sent to Leibnitz a delineation of a machine he had invented for that purpose, which was a piece of mechanism constructed with many wheels like a clock, and which Leibnitz highly approved of for land use, but doubted whether it would answer on board of ship, on account of the motion.

DIU, a celebrated island and fortress of Hindustan, in the province of Gujerat. It is six and a half miles long by one and a half broad, is nearly barren, and contains no good water, excepting what is collected in ponds during the rainy weather. It owes its fame to a noted Hindu temple, which rose to great celebrity, and was reckoned one of the richest places of the East. In the year 1025, Sultan Mahmood of Ghizni having overrun the province, entered the island, which is separated from the main land by a narrow strait only fordable at low water, and having taken the temple, broke the image in pieces, and found in it jewels to an incredible amount, and immense treasures also in the temple. In 1815 the Portuguese gained possession of Diu. They immediately commenced fortifying it, and in ten years rendered it impregnable against all the powers of India. It soon became a place of great trade and commerce, and was the harbour in which the fleets were laid up in winter. But with the decline of the Portuguese power it fell into decay, and was finally plundered by the Arabs of Muscat in 1670. It has since dwindled into insignificance, and has now little or no commerce. Long. 71. E. Lat. 20. 43. N.

DIVAL, in *Heraldry*, the herb nightshade, used by such as blazon by flowers and herbs, instead of colours and metals, for sable or black.

DIVALIA, in *Antiquity*, a feast held among the ancient Romans, on the 21st day of December, in honour of the goddess Angerona; whence it is called *Angeronalia*. On the day of this feast, the pontifices performed sacrifice in the temple of Voluptia, or the goddess of joy and pleasure, who, some say, was the same with Angerona, and supposed to drive away all the sorrows and chagrins of life.

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Divan
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Divination.

DIVAN, a council chamber or court of justice amongst the eastern nations, particularly the Turks. The word is Arabic, and signifies the same with *sofa* in the Turkish dialect.

The word is also used for a hall in the private houses of the orientals. The custom of China does not allow the receiving of visits in the inner parts of the house, but only at the entry, in a divan contrived on purpose for ceremonies.

DIVANDUROW, the name of seven islands which lie about a league north of the Maldives, and twenty-four from the coast of Malabar, almost opposite to Cananor.

DIVERGENT, or DIVERGING LINES, in *Geometry*, are those which constantly recede from each other.

DIVERGENT *Rays*, in *Optics*, are those which, going from a point of the visible object, are dispersed, and continually depart one from another in proportion as they are removed from the object; in which sense it is opposed to convergent.

DIVERSIFYING, in *Rhetoric*, is of infinite service to the orator; it is an accomplishment essential to his character, and may fitly be called the subject of all his tropes and figures. Vossius lays down six ways of diversifying a subject: 1. By enlarging on what was briefly mentioned before; 2. by a concise enumeration of what had been insisted on at length; 3. by adding something new to what is repeated; 4. by repeating only the principal heads of what had been said; 5. by transposing the words and periods; 6. by imitating them.

DIVERSION, in military affairs, is when an enemy is attacked in one place where they are weak and unprovided, in order to draw off their forces from another place where they have made, or intend to make, an irruption.

DIVESTING properly signifies undressing or stripping off one's garment, in contradistinction to investing. In law it is used for the act of surrendering or relinquishing one's effects. By a contract of donation or sale, the donor or seller is said to be disseised and divested of his property in such a commodity, and the donee or purchaser becomes invested therewith. A demise is a general divestiture which the fathers and mothers make of all their effects in favour of their children.

DIVINATION, the knowledge of things obscure or future, which cannot be attained by any natural means.

It was a received opinion amongst the heathens that the gods were wont to converse familiarly with some men, whom they endowed with extraordinary powers, and admitted to the knowledge of their councils and designs. Plato, Aristotle, Plutarch, Cicero, and others, divide divination into two sorts or species, viz. natural and artificial.

The former was so called, because not attained by any rules or precepts of art, but infused or inspired into the diviner, without his taking any further care about it than to purify and prepare himself for the reception of the divine afflatus. Of this kind were all those who delivered oracles, and foretold future events by inspiration, without observing external signs or accidents.

The second species of divination was called *artificial*, because it was not obtained by immediate inspiration, but proceeded upon certain experiments and observations arbitrarily instituted, and mostly superstitious. Of this sort there were various kinds, as by sacrifices, entrails, flame, cakes, flour, wine, water, birds, lots, verses, omens, and so on.

In holy Scripture we find mention made of nine different kinds of divination. The first was performed by the inspection of planets, stars, and clouds. It is supposed to be the practisers of this whom Moses calls *מעִינִין*, *meonen*, from *עָנָן*, *anan*, cloud (Deut. chap. xviii. ver. 10). 2. Those whom the prophet calls in the same place *מְנַחֵשֶׁה*, *menacheseh*, which the Vulgate and the generality of interpreters render *augur*. 3. Those who in the same place are called

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Divination. מְכַשֵּׁף, *mecascheph*, which the Septuagint and Vulgate translate "a man given to ill practices." 4. Such others whom Moses in the same chapter, verse 11, calls חוֹבֵר, *hhober*. 5. Those who consult the spirits called *Python*; or, as Moses expresses it in the same book, אֹנֵס אֵשׁ, "those who ask questions of Python." 6. Witches or magicians, whom Moses calls יִדְעֵי, *judeoni*. 7. Those who consult the dead, *necromancers*. 8. The prophet Hosea (chap. iv. ver. 12), mentions such as consult staves, שֹׁאֵל קֶסֶל; which kind of divination may be called *rhabdomancy*. 9. The last kind of divination mentioned in Scripture is *hepatascopy*, or the consideration of the liver.

Divination of all kinds was necessarily made an occult science, which naturally remained in the hands of the priests and priestesses, the magi, the soothsayers, the augurs, the visionaries, the priests of the oracles, the false prophets, and other like professors, till the time of the coming of Jesus Christ. The light of the gospel, it is true, has dissipated much of this darkness; but it is more difficult than is commonly conceived to eradicate from the human mind a deep-rooted superstition, even though the truth be set in the strongest light, especially when the error has been believed almost from the origin of the world; so that we still find existing among us the remains of this Pagan superstition in the chimeras which enthusiastic and designing men have formed into arts and sciences, though it must be owned, to the honour of the nineteenth century, that the pure doctrines of Christianity, and the spirit of philosophy, which become every day more diffused, equally concur in banishing these visionary opinions. The vogue for these pretended sciences and arts, moreover, is past, and they can no longer be named without exciting ridicule in all sensible people. By relating them here, therefore, and drawing them from their natural obscurity, we only mean to show their futility, and to mark those rocks against which the human mind, without the assistance of a pilot, might easily split.

For the attaining these supernatural qualifications, there are still existing in the world the remains of

1. *Astrology*; a conjectural science, which teaches to judge of the effects and influences of the stars, and to predict future events by the situation of the planets and their different aspects. It is divided into *natural astrology*, or *meteorology*; which is confined to the foretelling of natural effects, as the winds, rain, hail, and snow, frosts and tempests. In this consists one branch of the art of almanack-makers; and by merely confronting these predictions in the calendar with the weather which each day produces, every man of sense will see what regard is to be paid to this part of astrology. The other part, which is called *judicial astrology*, is still more illusive and absurd than the former; and having been at first the wonderful art of visionaries, it afterwards became that of impostors; a very common fate with all those chimerical sciences of which we are here treating. This art pretends to teach the method of predicting all sorts of events which shall happen upon the earth, as well such as relate to the public as those which concern private persons; and this by the same inspection of the stars and planets, and their different constellations. The *cabbala* signifies, in like manner, the knowledge of things which are above the moon, as the celestial bodies and their influences; and in this sense it is the same with judicial astrology, or forms part of it.

2. *Horoscopy*, which may also be considered as a part of

astrology, is the art of drawing a figure, or celestial scheme, containing the twelve houses, in which are marked the disposition of the heavens at a certain moment; for example, that at which a man is born, in order to foretell his fortune, or the incidents of his future life. In a word, it is the disposition of the stars and planets at the moment of any person's birth. But as there cannot be any probable or possible relation between the constellations and the human race, all the principles they lay down, and the prophecies they draw from them, are chimerical, false, absurd, and a criminal imposition on mankind.

3. The art of *augury* consisted, amongst the ancient Romans, in observing the flight, the singing, and eating of birds, especially such as were held sacred. See AUGURY.

4. The equally deceitful art of *haruspicy* consisted, on the contrary, in the inspection of the entrails of animals, but principally of victims, and from these predicting grand incidents relative to the republic, and the good or bad events of its enterprises.

5. *Aeromancy* was the art of divining by the air. This vain science has also come to us from the Pagans; but it is rejected by reason as well as Christianity, as false and absurd.

6. *Pyromancy* is a divination made by the inspection of a flame, either by observing to which side it turns, or by throwing into it some combustible matter, or a bladder filled with wine, or any thing else from which it was imagined that predictions might be drawn.

7. *Hydromancy* is the supposed art of divining by water. The Persians, according to Varro, invented this art. Pythagoras and Numa Pompilius both made use of it.

8. *Geomancy* was a divination made by observing cracks or clefts in the earth. It was also performed by points made on paper, or any other substance, at a venture; and future events were judged of from the figures which thence resulted. This was certainly very ridiculous; but it is nothing less so to pretend to predict future events by the inspection of the grounds of a dish of tea or coffee, or by cards, and many other like matters. Thus have designing men made use of the four elements to deceive their credulous brethren.

9. *Chiromancy* is the art which teaches to know, by inspecting the hand, not only the inclinations of a man, but his future destiny also. The fools or impostors who practise this art pretend that the different parts or the lines of the hand have a relation to the internal parts of the body, as some to the heart, others to the liver, spleen, &c. On this false supposition, and on many others equally extravagant, the principles of chiromancy are founded; and on which, however, several authors, as Robert Flud an Englishman, Artemidorus, M. de la Chambre, John of Indagina, and many others, have written treatises.

10. *Physiognomy*, or *physiognomancy*, is a science that pretends to teach the nature, the temperament, the understanding, and the inclinations of men, by the inspection of their countenances, and is therefore very little less frivolous than chiromancy; though Aristotle, and a number of learned men after him, have written express treatises concerning it.

DIVINE, something relating to God. The word is also used figuratively for any thing that is excellent, extraordinary, and that seems to go beyond the power of nature and the capacity of mankind.

DIVING.

Diving.

DIVING is the art of descending under water to considerable depths, and of remaining there some time, so as to be able to collect valuable articles, such as pearls (see PEARL FISHING), sponges, coral, and other submarine productions, from the bottom of the sea or rivers, or property from the sunken wrecks of vessels.

Difficulties of diving, from want of air in the lungs.

This art is one of great utility, but is attended with peculiar difficulties, owing to the very limited powers which man naturally possesses within the liquid element. On the surface he may no doubt continue a long time floating or swimming, and hence arises the wonderful art of navigation. But the moment he plunges within the mass he is cut off from the vital air, and life is speedily extinguished. The necessity of a constant supply of air for the support of life is shown by simply attempting to withhold it by shutting the mouth and nostrils. No one can continue holding in the breath in this manner much longer than a minute or a minute and a half. If we begin to hold after having made an expiration, we cannot do it longer than a quarter of a minute; but if we take a large inspiration, and fill the lungs, this supply is found to last longer; so that we can readily hold breath a full minute, and, with practice and great exertion, some may even continue to do so two minutes. Now this is exactly what the diver must do to remain alive under water; and accordingly we find that in general a person cannot remain longer than half a minute without the danger of suffocation, and the most practised divers not above two minutes; such is the necessity for fresh air continually present in the lungs.

Necessity of air, cause of.

The nature and cause of this necessity for air has been illustrated by the discoveries of modern chemistry. These have proved that it arises from a certain chemical action which the atmosphere exerts on the blood as it passes through the lungs, and which is continually going on, and cannot for a moment be intermitted. The nature of this action is not yet exactly understood, but the object of it undoubtedly is to purify the blood, as it becomes vitiated by circulating through the system. For this purpose, the air inspired into the lungs, and coming there into contact with the blood, imparts to it its oxygen, a small portion of which is supposed to combine with the blood, and to give it renewed vigour; but by far the greater portion combines with the carbonaceous matter of the blood, and carries off this impurity in the shape of carbonic acid at each expiration. This is proved by a very simple experiment. Let a person, for instance, respire by means of a pipe into a bag or bladder of air of the capacity of a gallon or more; he will breathe freely enough at first, but in a very short time with great difficulty, and at last will feel the sense of suffocation the same as in holding the breath in the ordinary way. If the air in the bladder be now examined, it will be found to have entirely changed its nature; it will no longer support the flame of a candle, but extinguish it the moment it is immersed, thus showing the loss of oxygen. Hence arises that sense of closeness and oppression which is felt in crowded assemblies, where, as generally happens, the ventilation is imperfect. The same air being breathed again and again, becomes unfit for respiration, and produces those unpleasant sensations which are usually felt. A very curious and interesting set of experiments on respiration were made by Messrs Allen and Pepys, and narrated in the *Philosophical Transactions* for 1808. The following bears particularly on the present subject.

“Three hundred cubic inches of common air contained in one of the mercurial gasometers were respired. In less

than a minute it became necessary to take deeper and deeper inspirations, and at last the efforts were so violent that the glass was in danger of being broken. A great sense of oppression and suffocation was now felt in the chest, vision became indistinct, and after the second minute the attention of the operator seemed to be withdrawn from surrounding objects, and fixed upon the experiment. A buzzing in the ears took place, as in breathing nitrous oxide; and after the third minute there was left only sufficient recollection to close the gasometer after an expiration; after which he became insensible, having made thirty-five inspirations. The expired air contained ten per cent. of carbonic acid, four of oxygen, and eighty-six of azote.”

With 300 cubic inches of air, then, in the gasometer, the operator began to be insensible in the space of two minutes; and if we suppose that the lungs, which were in their natural state at the commencement of the operation, contained 100 cubic inches of atmospheric air, then it would follow that 200 inches each minute would be necessary to support life, so as to remain at the same time quite sensible. Hence, supposing the lungs to contain, with a full inspiration, 250 cubic inches, which is a pretty large allowance, it would follow that a man might hold breath, or remain under water, a minute and a quarter, which agrees very well with what occurs in ordinary cases. But a very curious fact has been mentioned to us by Professor Faraday of the Royal Institution, London, and was first noticed to him by a gentleman connected with the Asiatic Society, a fact which may often be of great importance, not only in diving, but in cases of fire, and of accidents in brewers' vats, &c. The lungs in their natural state are charged with a large quantity of impure air, being a portion of the carbonic acid gas which is formed during respiration, but after each expiration still remains lodging among the involved passages of the pulmonary vessels. In proof of this, it is only necessary to breathe by a small pipe, or roll of paper, into a common water bottle, throwing away the first portion of the expiration, and propelling the last into the lower parts of the vessel. Then insert this over a taper, and it will be instantly extinguished. Now, by breathing hard for a short time, as one does after taking any violent exercise, this impure air is expelled, and its place is filled up with atmospheric air. The consequence is, that if we then take a full inspiration, the breath can easily be held for two minutes. This experiment any one can make. On trying it in the ordinary way, we could hold breath for about three quarters of a minute, but this with great difficulty. We then made eight to ten forced respirations, and on closing the mouth and nostrils felt no inconvenience even on the first trial, till after a minute and a half, but continued, however, to the end of the second minute. The knowledge of this fact might be of essential use in diving, and, we have no doubt, might often be the means of saving life; for if in the ordinary way we can only remain a single minute under water, of what importance is it to be capable of doubling the time? A single minute in these cases must be invaluable. Whether the professed divers are aware of this circumstance or not, we do not know; but it is probable, at any rate, that in many cases the exertion induced by swimming may have the effect of clearing the lungs. Another curious fact illustrative of the same principles occurred to Mr Brunell in descending to examine the breach which the river had made in the Tunnel under the Thames. Having lower-

Diving.

Quantity of air necessary; mode of increasing.

Diving. ed the diving-bell nearly thirty feet to the mouth of the opening, this was found too narrow to admit the bell, so that no further observation could be made on the state of the Shield and other works, which were perhaps eight or ten feet deeper. Brunell, therefore, laying hold of the end of a rope, left the bell, and dived himself down the opening; his companion in the bell being alarmed at the length of his stay, now about two minutes, gave the signal for pulling up; and the diver, unprepared for the signal, had hardly time to catch hold of the rope which he had let go, and was surprised on coming up to find that so much time had elapsed. On descending again, he found that he could with ease remain fully two minutes under water. The reason evidently was, that the atmosphere in the bell being condensed by a column of water nearly thirty feet in height, contained nearly double the quantity of air in the same bulk, and thus nearly a double supply in the lungs.

Difficulty from the pressure of the water. Besides the difficulty of holding the breath, another arises in diving, particularly at considerable depths, from the external pressure of the fluid on the chest, and on every cavity of the body. On the chest this tends to compress it together, and to expel the air out of it, and thus increases greatly the difficulty of holding the breath. At each foot of descent this pressure will increase upwards of sixty lbs. on every square foot of the body; and if we suppose the chest to expose half a square foot, we have, at the depth of fifteen feet, a force equal to the weight of 450 lbs. loading the chest, and tending to propel the included air. A very great muscular exertion, therefore, will evidently be required to resist this enormous strain; nor is it practicable, by any breastplate or other contrivance, to defend the chest from this pressure, as this, to do any good, would require to be so large, and of such strength, as greatly to obstruct the free motions of the diver. It is this pressure of the deep water, and the violent exertion necessary to overcome it, that causes, in divers who go down frequently, the eyes to become blood-shot, and brings on a spitting of blood.

Marvelous accounts of divers. The art of diving having always in it, and particularly during the infancy of science, something of the marvellous, the most extraordinary accounts have been given, by different authors, of the feats of some of the most noted divers. The most singular of these is that given by Kircher, of the Sicilian diver *Nicolo Pesce*, taken, as he states, from the archives of the kings of Sicily.

Sicilian diver. "In the times of Frederick king of Sicily," says Kircher, "there lived a celebrated diver, whose name was *Nicholas*, and who, from his amazing skill in swimming, and his perseverance under water, was surnamed the *fish*. This man had from his infancy been used to the sea, and earned his scanty subsistence by diving for corals and oysters, which he sold to the villagers on shore. His long acquaintance with the sea at last brought it to be almost his natural element. He was frequently known to spend five days in the midst of the waves, without any other provisions than the fish which he caught there, and ate raw. He often swam over from Sicily into Calabria, a tempestuous and dangerous passage, carrying letters from the king. He was frequently known to swim among the gulfs of the Lipari islands, noway apprehensive of danger.

"Some mariners out at sea one day observed something at some distance from them, which they regarded as a sea monster; but upon its approach it was known to be *Nicholas*, whom they took into their ship. When they asked him whither he was going in so stormy and rough a sea, and at such a distance from land, he showed them a packet of letters which he was carrying to one of the towns of Italy, exactly done up in a leather bag, in such a manner as that they could not be wetted by the sea. He kept

Diving. them thus company for some time in their voyage, conversing and asking questions; and after eating a hearty meal with them, he took his leave, and, jumping into the sea, pursued his voyage alone.

"In order to aid these powers of enduring in the deep, nature seemed to have assisted him in a very extraordinary manner; for the spaces between his fingers and toes were webbed, as in a goose; and his chest became so very capacious that he could take in, at one inspiration, as much breath as would serve him for a whole day.

"The account of so extraordinary a person did not fail to reach the king himself, who commanded *Nicholas* to be brought before him. It was no easy matter to find *Nicholas*, who generally spent his time in the solitudes of the deep; but at last, after much searching, he was found and brought before his majesty. The curiosity of this monarch had been long excited by the accounts he had heard of the bottom of the Gulf of Charybdis; he now therefore conceived that it would be a proper opportunity to have more certain information. He therefore commanded our poor diver to examine the bottom of this dreadful whirlpool, and, as an incitement to his obedience, he ordered a golden cup to be flung into it. *Nicholas* was not insensible of the danger to which he was exposed, dangers best known only to himself, and therefore he presumed to remonstrate; but the hopes of the reward, the desire of pleasing the king, and the pleasure of showing his skill, at last prevailed. He instantly jumped into the gulf, and was as instantly swallowed up in its bosom. He continued for three quarters of an hour below, during which time the king and his attendants remained on shore anxious for his fate; but he at last appeared, holding the cup in triumph in one hand, and making his way good among the waves with the other. It may be supposed he was received with applause when he came on shore; the cup was made the reward of his adventure; the king ordered him to be taken proper care of; and, as he was somewhat fatigued and debilitated by his labour, after a hearty meal he was put to bed, and permitted to refresh himself by sleeping."

The diver then, according to the account, gave a narrative of the wonders he had seen, which so excited the curiosity of the monarch, that he again tempted the diver to a second and fatal descent. After plunging into the whirlpool, he was never more heard of.

But to return to more authentic statements, these on the whole agree very well with the views already stated. Among the pearl divers at Ceylon and other parts of the East, instances have been known of a diver remaining six minutes under water; but these are very rare; the ordinary time seldom exceeds a minute, and sometimes it is a minute and a half, or two minutes. There are generally ten divers in each of the boats belonging to the fishery; five descend into the sea at a time, and the other five remain above to recruit their strength. In order to hasten their descent, a large stone is used, with a rope attached to it, which the diver seizes with the toes of his right foot, while he grasps a bag of net-work with those of the left. He then seizes another rope with his right hand, and keeping his nostrils shut with his left, plunges into the water, and soon reaches the bottom. Then hanging the net round his neck, he speedily collects the oysters, and resuming his former position, he makes a signal to those in the boat, and is immediately hauled up, and the stone which assisted his descent is pulled up afterwards.

The divers are all Indians, who are accustomed to this seemingly dangerous occupation from their infancy, and who fearlessly descend to the greatest depths. They will frequently make from forty to fifty plunges in a day; but the exertion is so extremely violent, that in coming up they

Diving. discharge water, and sometimes blood, from their mouths, ears, and nostrils. Some of them rub their bodies with oil, and stuff their ears to prevent the water from entering; but the greater part use no precautions whatever. They take no food while in the boats, nor till they return on shore and have bathed themselves in fresh water. The only danger to which they are exposed is from meeting, while at the bottom, with the ground-shark, which is a common inhabitant of those seas, and of which the divers are under dreadful apprehensions; some of them indeed are so expert as to avoid this enemy, even when they remain under water for a considerable time; but the uncertainty of escaping is so great, that, in order to avert the danger, they consult, before they begin, their priests or conjurors, in whom they place implicit confidence.

Florida
Indian
divers.

Use of
sponges.

Dr Halley relates, as a remarkable circumstance, that he observed a Florida Indian diver at Bermudas, who could remain two minutes under water. He states, that the divers for sponges in the Archipelago are in the practice of taking down in their mouths a piece of sponge dipped in oil, and by this are enabled to dive longer than others who have none. It is not easy to conceive how this can assist the diver's breathing; for the introduction of any foreign substance into the mouth must necessarily diminish the quantity of air he can take down. But it has been lately said that the real object of taking oil in their mouth is to calm those small waves on the surface of the sea which prevent the light being so steadily transmitted to the bottom as is necessary to enable the divers to find the small objects they search for without delay. By ejecting a little oil from their mouths, it rises to the surface, and spreading upon it, calms the waves in a most remarkable manner, and gives a brilliant light at the bottom.

South Sea
divers.

Many nations, and particularly the savages in the South Sea and other islands, are remarkable for the expertness they acquire by habit in diving and moving about in the water. Being accustomed to it from their infancy, the element becomes so natural to them that they seem to have the use of all their faculties in the water the same as on the dry land. According to the accounts of voyagers, they are such expert divers, that when a nail or other piece of iron was thrown overboard, they would instantly jump into the sea after it, and never fail to recover it. On one occasion a smith's anvil is said to have fallen overboard. Not being able to bring this up, the islanders notwithstanding contrived to bring it ashore, by descending a great many times to the bottom, and rolling it over and over till it reached the land.

Apparatus
for aiding
the divers.

Such is the length to which diving has been carried by the natural powers of the body alone. But from the curious and difficult nature of the object, and the many important purposes to which the art might be employed, ingenious men were led to the invention of various contrivances for the use of the diver, which have greatly extended his powers and the usefulness of the art. A multitude of these contrivances of different descriptions have been brought forward by mechanical projectors for the last two hundred years. They all resolve themselves into three different kinds.

1st, Water-tight armour or dresses for the body, so strong as to protect it from the external pressure of the fluid; and, along with this, the means of supplying the diver with fresh air, so as to enable him to remain any time under water.

2dly, Water-tight vessels of metal for inclosing the diver, and of such capacity as to contain a supply of air for a limited period of perhaps half an hour or an hour or more, and giving him also the use of his hands and arms externally by a sort of flexible sleeves.

3dly, The diving-bell, which, from its simplicity, safety, and perfect efficiency, has now almost entirely superseded every other, though there is no doubt that in many cases these may still be of considerable utility in subservience to the bell.

Diving.

In regard to dresses or armour, a number of different plans of this kind are detailed in Leopold's *Theatrum Machinarum Hydraulicarum*. At depths of twelve or fifteen feet these may often be of essential use; but beyond this they become inapplicable, owing to the great pressure on the limbs of the diver, which must either be exposed, or covered only with a flexible material, not to impede his motions; and in that case the pressure, acting on all sides like a ligature, is liable to obstruct the circulation of the blood in the limbs, and to drive it from these into those parts of the body within the armour, causing extreme pain. In any great depth, also, the necessary strength of the armour renders it unwieldy; and it is extremely difficult, if not impracticable, to fit it tightly on every part; while the smallest opening, by admitting water, may endanger the life of the diver.

Water-tight
armour.

One of the best of these contrivances is perhaps that proposed by M. Klingert, and described in a pamphlet published at Breslau in 1798. The harness or armour is made of strong tin-plate, in the form of a cylinder, with a round end to inclose the head and body, and, for the convenience of putting it on, is made in two parts, the head-piece or helmet, and the body. Besides this, there is a leather jacket, with short sleeves, and a pair of drawers of the same, which are made water-tight, buttoned on the metal part where they join, and made tight with brass hoops, going round the leather and the metal upon the outside. The chief peculiarity in this machine is the mode in which fresh air is supplied, and respiration effected. This is done by two distinct flexible pipes proceeding from the inside of the helmet to the surface of the water; the one is for inhaling the air, and terminates in an ivory mouth-piece, which the diver may embrace with his lips and inhale the air; the other enters the helmet at the same place, and opens merely into the inside of the machine, so as to allow the foul air to be discharged. The diver, therefore, draws in the fresh air by the mouth, and discharges it into the helmet by the nostrils; and from the interior of the machine it is propelled by the act of inspiration, the expansion of the chest contracting the space between it and the armour, and forcing out exactly as much air as is drawn in, keeping up always a due equilibrium. This is certainly a very ingenious arrangement; for, if there were no second pipe to discharge the air, the expansion of the chest would compress the air round the body of the diver, and, unless this were of large capacity, which would be inconvenient, would create a difficulty in the operation. The construction of the apparatus will be understood from the drawing, fig. 1, Plate CLXXXIX., which is a front view of the diver, and by the following description: A is the helmet-piece, fifteen inches in height, and the diameter adapted to the size of the body of the diver; BB is the lower part of the cylinder, of the same diameter, and of such a height as to meet the other at the dotted line C; ddC is the jacket, and ffE the drawers; these are attached to the cylinder by buttons, as seen; and a, c, bb are the three brass hoops fitted over each joint to make it water-tight; the hoops are made of brass-plate, with their ends turned up, and fitted with screws, by means of which they can be drawn very tight upon the leather. The cylinder has holes for the arms, one half in the upper piece and one half in the lower; and when the jacket is fastened on, it binds the upper and lower parts of the cylinder together. It is fastened at the arms with brass screw hoops, dd, and the

Diving. drawers by similar ones at *ff*; *h h* represent the breathing pipes, the first for drawing in the air, the second for discharging it; these are united to a little metal cylinder, which screws on the helmet at the aperture *g*; this is shown more particularly at fig. 2, where a partition will be observed in the cylinder dividing the fresh air compartment from the other, the one terminating in the ivory mouth-piece *v*, the other just entering the machine at *t*. *W* is a small reservoir at the lower part of the pipes, for condensing any air, or receiving what may penetrate through the pipes. To resist the external pressure of the water on the limbs, the leather drawers have a framing of iron within them, represented at fig. 3; this consists of a semicircular piece *ll*, also seen at *ll*, fig. 1, extending between the legs of the diver, and fastened to the lower extremity of the cylinder at the front and back; also two irons *nn* outside the thighs, which are jointed to the cylinder, and extend down to *f*, where they are attached to a hoop surrounding the thigh; there is another hoop for each thigh farther up at *q*; these hoops are farther connected by irons, which at the upper end are fitted to slide upon the semicircular hoop, as at *t*; and by this means, though the frame-work is very strong, the diver is at liberty to walk. *ww* are weights hooked on the cylinder, to keep the diver down. *P* is a small pump for discharging any leakage water which may penetrate through the joints.

When the different parts of the machine have been fitted to the body of the diver, and the proper weights are attached, he enters the water till it rises as high as his eyes, while the end of the pipe is held by an assistant above the surface; and if he finds that he can breathe freely, and no water is forced into the pipe, he may venture to go deeper; and, stopping for some time, to ascertain whether respiration be not inconvenient from the want of fresh air, he may advance to still greater depths, while he makes the proper signals by means of the rope which is secured to one of his arms, or by speaking through the pipe. By this kind of exercise for some time, the diver acquires confidence and ease for conducting the necessary operations. When he is desirous of ascending he has only to unhook the weights attached to the apparatus, or to fix them to a rope let down for the purpose, that they may not be lost, and as he is then lighter than the same bulk of water, he rises to the surface.

By following these directions, any one may be able to use the apparatus, and dive to moderate depths, in a very short time. In one of the trials upon the Oder, near Breslau, the diver was a huntsman taught by the author; the water was of considerable depth, and the current strong, and there were a great number of spectators present. He sawed through the trunk of a tree which was lying at the bottom; he showed also that he could have fastened sunk bodies to a rope in order to be drawn up, and that in case any impediment should prevent the use of the saw, the trunks of trees might be hewed to pieces by an axe. On the whole, this apparatus, or one similar, might certainly be of great use in many cases, particularly in hydraulic works, where the diving-bell and the machinery connected with it might not be attainable. The water-proof cloth of Mackintosh might also be substituted with good effect for the leather.

Apparatus by Tonkin. Another mode of supplying air to the diving apparatus has been adopted in some cases. This consists in forcing the fresh air into the machine by a bellows or pump, till its elastic force is equal to the pressure of the water. The foul air may in this case be suffered to escape into the water through a valve, or may be conducted to the surface by a pipe. Of this kind is the apparatus contrived by Mr Tonkin, and employed for some time in raising parts of the wreck of the Abergavenny East India ship, which was

unfortunately lost off Weymouth in 1804. It consisted of a body of copper with iron boots, put together and jointed in the manner of coats of mail; the whole is then covered with leather, and afterwards with canvass to distinguish it under water. The arms are made of strong water-proof leather; and the place for sight is about eight inches diameter, glazed over with a plate of glass an inch thick. The diver is sunk in this machine by means of weights, fastened equatorially round the waist of it; and he is suspended by a rope, by means of which his situation is changed at pleasure. A flexible air-tube communicates with an air-vessel in the boat above. Through this tube the diver gives his instructions and obtains his supply of fresh air. This machine was used with very good effect in a depth of water of near seven fathoms, and enabled the diver to direct the operations of several curious machines, such as saws for clearing away the ship's decks, and making sufficient openings to give him access to the treasure below, as well as tongs, &c. for taking up the heavy goods by tackle in the vessel above.

In regard to the second kind of diving machines, that Borelli's proposed by Borelli is only curious as showing the low state of physical knowledge in his time. He proposed to have a copper vessel, or vesica as he terms it, about two feet diameter, to contain the diver's head, and to be fixed to a habit of goat skin for the body. Within the vessel there were pipes contrived to produce a circulation of air, by which Borelli supposed that the objections to other diving machines from the want of air would be obviated; "the moisture," as he says, "by which it is clogged in respiration, and by which it is rendered unfit for the same use again, being taken from it by its circulation through the pipes, to the sides of which it would adhere, and leave the air as free as before." It also contained an air-pump, by means of which the diver could raise or lower the apparatus, by condensing or rarefying the air, on the principle of the air-bladder of fishes.

Mr Martin, in his *Philosophia Britannica*, mentions an apparatus contrived by an Englishman, consisting of strong leather, so prepared that no air could pass through. It fitted to his arms and legs, and had a glass window placed in the fore part of it. When dressed in this apparatus, which was large enough to contain half a hogshead of air, he could walk on the ground at the bottom of the sea, and enter the cabin of a sunk ship to take out the goods. The inventor is said to have himself used this machine very extensively in recovering wrecks, and with such success as to have acquired considerable property by it. We are not informed of the depths to which he descended.

Mr Klingert, the inventor of the water armour, also contrived a diving chest, of the form of a hollow cylinder, to be used along with it. This contained fifty-eight cubic feet of air, which, he estimated, would last two hours. It was suspended from a boat, but could be raised and depressed independently of this by a pump compressing or dilating the included air. Thus the ballast is so adapted to the size of the machine, as to make it sink so far that only a cubic foot of it remains above water. In this state an additional weight of a hundred pounds will depress it below the surface, or make it sink to the bottom. The effect of adding extra weights is produced by diminishing the volume of contained air, by condensing it into a smaller space. To accomplish this, a large cylinder is applied in the bottom of the vessel, and provided with a piston, which, by a rack and pinion, can be moved from one end of the cylinder to the other, when the diver turns a handle, coming through the side of the machine, and communicating motion by a worm and wheel to the pinion of the rack before mentioned. The lower end of the cylinder is open to the water, and the upper end opens

Diving.

Borelli's
diving
bladder.Leather
diving
chest.Klingert's
diving
chest.

Diving. within the machine; therefore, when the diver turns the handle in the direction to raise up the piston in its cylinder, it necessarily diminishes the bulk of the included air, and the machine will sink; but on depressing the piston in the cylinder, it will ascend again. The inventor proposed to furnish the machine with two small oars to move it in the water, and an anchor or grapnel to make it fast whilst the diver walks about on the bottom, within the limits of the length of the pipe, to examine sunk bodies, and discover the best mode of raising them. To prevent danger from any accident happening to the machine, the diver is to be provided with the means of quickly detaching the pipes from the machine, and retaining a sufficiency of air in the armour to carry him to the surface when he throws off the weight suspended from his girdle.

Rowe's
diving
chest.

Another diving machine or chest was invented by Mr Rowe in 1753, and is represented in Plate CLXXXIX. fig. 4. It consists of a trunk or hollow copper vessel AB, soldered or riveted together with strength proportioned to the depth of water where it is to be fixed. It contains the diver's body, and also a sufficiency of air for the time he intends to dive. He enters with his feet first at the open end A, which is then closed by a lid or cover screwed on by a number of screw bolts passing through the flanches. The vessel is bent at F, for the bearing of the diver's knees, and has a sufficiency of leaden ballast at B to sink it in the right position. There are two hoops surrounding it, which, at the same time that they strengthen it, afford points of suspension by a bar, which is attached to them, and is pierced with several holes to admit a span upon the rope, which is so adjusted as to suspend the whole, with the diver in it, nearly in the position of the figure, when he will be in a convenient posture for working with his arms, which come through openings C in the vessel, to which sleeves E, of very strong leather, are attached by a hoop or ring, screwed to the vessel with the leather between them. The sleeves are lined with cloth, and the edges round the holes are defended by soft quilting, from hurting the diver's arms by the pressure, as well as to prevent the sleeves and his arms being thrust inwards. D is an aperture covered by a strong lens, for the diver to see through. At H and G are two other openings in the upper part of the vessel, covered by screw caps, which are removed when fresh air is to be introduced into the machine by the nose pipe of a pair of bellows being applied to force fresh air into one, and drive out the foul air at the other. The lower opening is also of use to pump out any water which may leak through at the joints, though this is as much as possible prevented by fitting leather into the joints of the cover and the caps before they are screwed tight. The mass of lead F is fastened to the lower side of the vessel in a line between the diver's arms, by means of hoops. On this the whole rests if it comes to the ground, and remains in a proper position for the diver to work, and fasten ropes to any thing which is to be drawn up, as shown in fig. 5.

If the water be very deep, the diver must wear a kind of saddle on his back, which, having a ridge touching the top part of the vessel withinside, enables him to keep his arms properly out of the apertures, otherwise he would not have strength to resist the pressure acting upon the surface of the arms and sleeves, which forces them into it with a weight proportional to the quantity of surface exposed, and to the depth of water. The diver gives his instruction to those above by a small line, which is laid through a staple at the side of the machine, and has a handle always hanging in reach of the diver's hand. The upper part of this line is held by a person in the boat or ship above, to whom any signal is given, by the diver

snatching or twitching the line a certain number of times, as has before been agreed upon. This is immediately felt by the person above, who gives orders accordingly. The size of the vessel is such that he can continue at the bottom about half an hour, without any pipes or other supply, and will be enabled to do many things very readily, such as recovering moorings, chains lost in rivers or harbours, hooking ropes for weighing up lost anchors, or any other purpose where there is free access to the object sought; though in entering and searching the wrecks of ships, it would be less convenient than some others which we shall describe.

Besides the above, several other projects of a similar *Diving machine* have been proposed, not only with means within it-*chine* to self of raising and lowering the vessel, but with contri-*move* vances in the shape of screw arms for moving it when *under* under water in any direction; but none with much success. This is said to have been tried in the reign of King James I. by a famous English projector, Cornelius Drebell, who, we are told by Mr Boyle, made a submarine vessel, which would carry twelve rowers besides the passengers; and that he had also discovered a liquid which had the singular property of restoring the air when it became impure by breathing. This last circumstance, with the number of persons inclosed in the machine, and the imperfect state of mechanics at the period alluded to, render the whole story extremely improbable, though it shows clearly that the idea had been entertained, and perhaps some attempt made. The celebrated Bishop Wilkins, in his *Mathematical Magic*, takes up the scheme of Drebell, and, with all the sanguine facilities of a projector, describes the benefits of these submarine enterprises. The submarine vessel of Mr Bushnell of Connecticut, in America, constructed in 1787, though very complex, appears to have been a curious and ingenious machine, and to have promised success if persevered in, according to the accounts published of it. It was intended to act chiefly as an engine of war, by advancing under water towards an enemy's ship, and fixing in the bottom of it a magazine of powder, which, by peculiar contrivances, was intended to take fire after the machine had got to a sufficient distance to be out of danger. But if this be the only use of such a machine, its failure need not be regretted. Let us now turn, then, to the most important of all diving machines yet contrived, namely,

THE DIVING-BELL.

The principle of the diving-bell is extremely simple. *General principles.* Let any one insert a wine glass in a tumbler of water; on sinking it to the bottom, the inside of the glass will be observed to remain nearly full of air, so that any small object within the glass will remain perfectly dry, the included air being confined on all sides, and by its impenetrability excluding the water from its place. If this experiment be made with a pretty large bell-glass, inverted over a taper floating on the surface of the water in a still larger vessel, the taper will be observed to descend with the glass to the bottom; and though surrounded on all sides with water, it will be found to remain perfectly dry, and to continue burning for some time. Conceive then a vessel of wood or metal, in the shape of a wine-glass or truncated cone, but so large as, when inverted, to admit several persons within it, sitting, for instance, on a board along one of the sides. Let the whole then be suspended by a rope or chain over the side of a vessel, with a jib pulley and crane, to lower or raise the machine at pleasure. Then, on the machine being lowered and loaded with sufficient weight to sink it, the persons may all descend to a great depth in the sea, without being wetted in the small-

Diving-
Bell.

History.

est degree; and there is nothing to prevent them remaining any time in this situation, and moving about and doing operations at great depths.

The above, then, was the original construction of the diving-bell; and the great advantage of it, and what distinguishes it above every other similar invention, and renders it vastly superior, is, that being perfectly open below, the divers can get out and in with the utmost facility. This invention, according to Professor Beckmann, is generally assigned to the sixteenth century; and "I am of opinion," says he, "that it was little known before that period. We read, however, that in the time of Aristotle divers used a kind of kettle, to enable them to continue longer under the water; but the manner in which it was employed is not clearly described. The oldest information which we have of the use of the diving-bell in Europe is that of John Taisnier, who was born in Hainault in 1509, and had a place at court under Charles V., whom he attended on his voyage to Africa. He relates in what manner he saw, at Toledo, in the presence of the emperor and several thousand spectators, two Greeks let themselves down under water, in a large inverted kettle, with a burning light, and rise up again without being wet. It appears that this art was then new to the emperor and the Spaniards, and that the Greeks were caused to make the experiment in order to prove the possibility of it."

"When the English in 1588 dispersed the Spanish fleet called the Invincible Armada, part of the ships went to the bottom, near the Isle of Mull, on the western coast of Scotland; and some of these, according to the account of the Spanish prisoners, contained great riches. This information excited, from time to time, the avarice of speculators, and gave rise to several attempts to procure part of the lost treasure. In the year 1665, a person was so fortunate as to bring up some cannon, which, however, were not sufficient to defray the expenses. Of these attempts, and the kind of diving-bell used in them, the reader will find an account in a work printed at Rotterdam in 1669, and entitled *G. Sinclari Ars nova et magna gravitatis et levitatis*. In the year 1680, William Phipps, a native of America, formed a project for searching and unloading a rich Spanish ship sunk on the coast of Hispaniola; and represented his plan in such a plausible manner, that King Charles II. gave him a ship, and furnished him with every thing necessary for the undertaking. He set sail in the year 1603; but being unsuccessful, returned again in great poverty, though with a firm conviction of the possibility of his scheme. By a subscription, promoted chiefly by the Duke of Albemarle, the son of the celebrated Monk, Phipps was enabled, in 1687, to try his fortune once more, having previously engaged to divide the profit according to the twenty shares of which the subscription consisted. At first all his labour proved fruitless; but at last, when his patience was almost entirely exhausted, he was so lucky as to bring up, from the depth of six or seven fathoms, so much treasure, that he returned to England with the value of L.200,000. Of this sum he himself got about sixteen, others say twenty thousand, and the duke ninety thousand pounds. After he came back, some persons endeavoured to persuade the king to seize both the ship and the cargo, under a pretence that Phipps, when he solicited for his majesty's permission, had not given accurate information respecting the business. But the king answered, with much greatness of mind, that he knew Phipps to be an honest man, and that he and his friends should share the whole among them, had he returned with double the value. His majesty even conferred upon him the honour of knighthood, to show how much he was satisfied with his conduct. We know not the construction of Phipps's apparatus; but of the old figures

of a diving-machine, that which approaches nearest to the diving-bell is in a book on fortification by Lorini; who describes a square box bound round with iron, which is furnished with windows, and has a stool affixed to it for the diver. This ingenious contrivance appears, however, to be older than that Italian; at least he does not pretend to be the inventor of it.

"In the year 1617, Francis Kessler gave a description of his water-armour, intended also for diving, but which cannot really be used for that purpose. In the year 1671, Witsen taught, in a better manner than any of his predecessors, the construction and use of the diving-bell; but he is much mistaken when he says that it was invented at Amsterdam. In 1679 appeared, for the first time, Borelli's well-known work *De Motu Animalium*; in which he not only described the diving-bell, but also proposed another, the impracticability of which was shown by James Bernoulli. When Sturm published his *Collegium curiosum* in 1678, he proposed some hints for the improvement of this machine, on which remarks were made in the *Journal des Sçavans*." The diving-bell, as hitherto used in the above simple form, is liable to two great defects, viz.

1. The elasticity of the included air prevents it from resisting entirely the entrance of the water into the lower part of the bell. The water, by the universal law of fluids, presses the bell on all sides, in proportion to the depth of the immersion. This pressure therefore it exerts upwards on the bottom of the bell, and against the included air; but the air being extremely compressible, yields to the pressure, and is contracted into a smaller volume, allowing the water to enter and occupy the lower portion of the bell. Such is the effect of this pressure, that at the depth of thirty-three feet the air becomes compressed into half its volume, and the bell fills half full of water; and the same proportion at every other depth. But,

2. The air within the bell, by continued respiration, becomes speedily unfit to support life; and the whole apparatus therefore must be raised from time to time, to receive a fresh supply. Suppose that only two persons descend in the bell at a time, we have seen that a supply of two hundred cubic inches of air per minute is absolutely necessary for each person to keep in life and sensibility. But in order to breathe freely, at least double that quantity would be required; say for two persons half a cubic foot per minute. If then we have a bell six feet long, and four feet average diameter, this would contain about seventy cubic feet, and would last upwards of two hours. So that for at least one hour or more respiration might be carried on with all manner of freedom.

At great depths, such as twenty, thirty, forty, and sixty feet, where the usual pressure on the body from the atmosphere above is doubled and tripled, amounting in the latter case to nearly forty pounds in every square inch, one would imagine that respiration, and indeed the whole system of the body, would be deranged under so thick and confined an atmosphere. But experience proves that no great inconvenience arises from this circumstance; and the reason is, that the air pressing into every cavity within the body, as well as externally, the pressure is exactly balanced; so that the effect of the actual increase is rendered nearly insensible. The only particular sensation felt in descending in the bell is a severe pain in the ears, particularly at first. This increases a little as we descend, but, after resting at the bottom, goes entirely off. It arises from the effect of the condensed air acting externally on the tympanum of the ear, before the air within the tympanic cavity has acquired the same density to counterbalance it. The tympanum on the outside communicates directly with the atmosphere, the pressure of which therefore acts instantaneously. But on the inside the tympanum bounds

Diving-
Bell.Effects of
pressure.Pain in the
ears.

Diving-Bell.

the tympanic cavity; and this has no communication with the external air, excepting by the Eustachian tube, which leads from the cavity into the mouth. Through this tube, therefore, the condensed air must pass from the mouth, to supply what is necessary within the cavity for restoring the same equilibrium within and without. But the Eustachian tube is a long and narrow passage; at its commencement in the ear it has a bony structure, but towards its termination in the mouth, behind the nostrils, it becomes soft and fleshy, so as readily to close the passage, particularly with any pressure acting externally. It admits therefore an easy passage from the ear to the mouth; but when any pressure arises in the opposite direction, it acts in some degree like a valve, shutting the passage, until the increasing pressure again forces it open. Some time then elapses before all this can be accomplished; and during this time the external air pressing with full force on the tympanum, produces the pain which is felt. When the Eustachian tube opens, it is generally all of a sudden, and with a slight explosion or pop, which is followed by instant relief from the pain. This relief may often be produced by filling the mouth, or gulping the air and pressing it into the tube.

Different accounts have been given of this effect on the ears in the diving-bell; but the above seems the most accurate, and what really takes place. The effect, indeed, may be shown experimentally by shutting the mouth and nostrils, and exhausting the air from them by the action of the lungs. The air in the tympanic cavity immediately rushing through the Eustachian tube into the mouth, the external air acts on the tympanum, and produces a slight sensation of deafness, such as is felt in the bell. But, instead of exhausting the air, attempt to compress it, and force it through the tube into the internal ear; at first no effect is produced: but after exerting a considerable pressure, a slight pop is felt, and a little pain in the ear, which is just the sudden opening of the tube.

The great inconveniences of the diving-bell already mentioned were completely removed by the labours of the celebrated and ingenious philosopher Dr Halley, who about the year 1715 introduced the grand improvement of supplying it with fresh air for any length of time without raising the bell out of the water. This he effected by letting down from the vessel from which the bell was suspended, barrels of fresh air, which, by means of pipes, discharged their contents into the bell; while the foul air escaped by a small cock in the top of the bell. In this manner the air within the bell was kept perfectly fresh, and for any length of time. Another remarkable advantage arose from this plan. The force of the air in the barrels was made to discharge the whole of the water out of the bell, which the elasticity of the included air had hitherto allowed to enter and partially to fill the cavity. This was easily done by stopping the cock at the top, and letting down the barrels below the level of the bell, by which means the air included in them received a sufficient preponderating pressure to enter the bell and drive out the water. In this manner the whole cavity of the bell became available for working; and, what was of still more importance, the diver could with ease descend and walk on the bottom of the sea, the feet being only slightly immersed. The following is the interesting account which Dr Halley gives of his arrangements:

"The bell I made use of was of wood, containing about sixty cubic feet in its concavity, and was of the form of a truncated cone, whose diameter at the top was three feet, and at the bottom five. This I coated with lead so heavy that it would sink empty; and I distributed the weight so about its bottom, that it would go down in a perpendicular direction, and no other. In the top I fixed a strong but

clear glass, as a window, to let in the light from above; and likewise a cock to let out the hot air that had been breathed; and below, about a yard under the bell, I placed a stage, which hung by three ropes, each of which was charged with about one hundredweight to keep it steady. This machine I suspended from the mast of a ship by a sprit, which was sufficiently secured by stays to the mast head, and was directed by braces to carry it overboard clear of the ship's side, and to bring it again within board, as occasion required.

"To supply air to this bell when under water, I caused a couple of barrels, of about thirty-six gallons each, to be cased with lead, so as to sink empty; each of them having a bung-hole in its lowest parts to let in the water as the air in them condensed on their descent, and to let it out again when they were drawn up full from below. And to a hole in the uppermost part of these barrels I fixed a leathern trunk or hose well liquored with bees-wax and oil, and long enough to fall below the bung-hole, being kept down by a weight appended; so that the air in the upper part of the barrels could not escape, unless the lower ends of these hose were first lifted up.

"The air-barrels being thus prepared, I fitted them with tackle proper to make them rise and fall alternately, after the manner of two buckets in a well; which was done with so much ease, that two men, with less than half their strength, could perform all the labour required; and in their descent they were directed by lines fastened to the under edge of the bell, which passed through rings on both sides of the leathern hose in each barrel; so that, sliding down by these lines, they came readily to the hand of a man who stood on the stage on purpose to receive them, and to take up the ends of the hose into the bell. Through these hose, as soon as their ends came above the surface of the water in the barrels, all the air that was included in the upper parts of them was blown with great force into the bell, whilst the water entered at the bung-holes below, and filled them; and as soon as the air of one barrel had been thus received, upon a signal given, that was drawn up, and at the same time the other descended, and, by an alternate succession, furnished air so quick, and in so great plenty, that I myself have been one of five who have been together at the bottom in nine or ten fathom water, for above an hour and a half at a time, without any sort of ill consequence; and I might have continued there as long as I pleased, for any thing that appeared to the contrary. Besides, the whole cavity of the bell was kept entirely free from water, so that I sat on a bench which was diametrically placed near the bottom, wholly dressed, with all my clothes on. I only observed that it was necessary to be let down gradually at first, as about twelve feet at a time; and then to stop and drive out the air that entered, by receiving three or four barrels of fresh air before I descended further. But being arrived at the depth designed, I then let out as much of the hot air that had been breathed as each barrel would replenish with cool, by means of the cock at the top of the bell; through whose aperture, though very small, the air would rush with so much violence as to make the surface of the sea boil, and to cover it with a white foam, notwithstanding the weight of the water over us.

"Thus I found that I could do any thing that required to be done just under us; and that, by taking off the stage, I could, for a space as wide as the circuit of the bell, lay the bottom of the sea so far dry as not to be over shoes thereon. And, by the glass window, so much light was transmitted, that when the sea was clear, and especially when the sun shone, I could see perfectly well to write or read, much more to fasten or lay hold on any thing under us that was to be taken up. And, by the re-

Diving-Bell.

Diving-
Bell.

turn of the air-barrels, I often sent up orders written with an iron pen, on small plates of lead, directing how to move us from place to place as occasion required. At other times, when the water was troubled and thick, it would be as dark as night below; but in such cases I have been able to keep a candle burning in the bell as long as I pleased, notwithstanding the great expense of air necessary to maintain flame. This I take to be an invention applicable to various uses, such as fishing for pearls, diving for coral or sponges, and the like, in far greater depths than has hitherto been thought possible. Also for the fitting and placing of the foundations of moles, bridges, &c. in rocky bottoms, and for the cleaning and scrubbing of ships' bottoms when foul, in calm weather, at sea. I shall only intimate, that by an additional contrivance, I have found it not impracticable for a diver to go out of an engine to a good distance from it, the air being conveyed to him with a continued stream, by small flexible pipes; which pipes may serve as a clue to direct him back again when he would return to the bell."

Plate CLXXXIX., fig. 5, represents the construction and operations of Dr Halley's bell as thus described.

In 1721, shortly after the above experiments were made, Dr Halley contrived additional apparatus, to enable the diver to go out from the bell to a considerable distance, and stay a sufficient time in the sea, and walk about on the bottom, with full freedom to act as occasion required. Considering that the pressure being greater on the surface of the water in the bell than on any other surface which was higher than that in the bell, the air would pass by a pipe from the bell into any cavity for air; where the surface of the water was higher, he concluded that a man, by putting on his head a bell or cap of lead, made sufficiently heavy to sink empty, and in form resembling the bell itself, might keep his head dry, and might receive a constant stream of air from the great bell, so long as the surface of the water in the cap was above the level of that in the bell, by means of a flexible pipe which he would carry coiled on his arm.

In pursuance of this idea he procured pipes to be made, which answered all that was expected from them. They were secured against the pressure of the water by a spiral brass wire, which kept them open from end to end, the diameter of the cavity being about the sixth part of an inch. These wires being coated with thin glove leather, and neatly sewed, were dipped into a mixture of hot oil and bees-wax, which, filling up the pores of the leather, made it impenetrable to water; several thicknesses of sheep's entrails were then drawn over them, which, when dry, were covered with paint, and then the whole defended with another coat of leather to keep them from fretting. Several of the pipes were as much as forty feet long, the size of a half inch rope. One end of a pipe being fixed in the bell at some height above the water, the other end was fastened to a cock which opened into the cap. The use of the cock was to stop the return of the air whenever there was occasion to stoop down or go below the surface of the air in the bell, which occurred as often as there was occasion to go out or return into the machine. The diver, therefore, when he has descended to the bottom in the great bell, puts on his cap with the pipe hanging on his arm like the coil of a rope. As soon as he leaves the bell, he opens the cock in the pipe, and walks on the bottom of the sea, giving out the coils of his pipe as it is required; and this serves as a clue to direct him back again to the great bell, from whence he derives his supply of air by means of the pipe.

The weight of a man being very little more than that of his bulk in water, he could not act with any strength, nor stand with any firmness, especially if there is any current,

without a considerable addition of weight; the leaden caps were therefore made to weigh about half a hundred-weight, to which was added a girdle for the waist, formed of large weights of lead nearly of as great weight in the whole; also two clogs of lead for the feet, of about twelve pounds each. With this accession of weight Dr Halley found a man could stand well in an ordinary stream, and even go against it. It is necessary for the diver to be provided against the cold of the water, which, though it could not be removed so that a man could endure it long, yet it was much eased by wearing a waistcoat and drawers made close to the body, of that thick woollen stuff of which blankets are made. This becoming full of water, would be a little warmed by the heat of the body, and keep off the chill of new cold water coming on.

When the water is not turbid, things are seen sufficiently distinct at the bottom of the sea; but a small degree of thickness makes perfect night in a moderate depth of water. To obtain an open view from the leaden caps, which, from their use, the doctor called caps of maintenance, he at first used a plain glass before the sight, but soon found that the vapour of the breath made such a dew on the surface of the glass that it lost its transparency. To remedy this, he found it necessary to prolong that side of the cap which was before the eyes, and thereby enlarge the prospect of what was beneath.

Another plan of the diving-bell was proposed by Mr Martin Triewald, F. R. S. and military architect to the king of Sweden, which, for a single person, is in some respects thought to be more eligible than Dr Halley's, and is constructed as follows. AB, fig. 6, is the bell, which is sunk by lead weights DD hung to its bottom. This bell is of copper, and tinned all over in the inside, which is illuminated by three strong convex lenses P, with copper lids to defend them. The iron ring or plate below the bell serves the diver to stand on when he is at work, and is suspended at such a distance from the bottom of the bell by the chains, that when the diver stands upright, his head is just above the water in the bell, where the air is much better than higher up, because it is colder, and consequently more fit for respiration. But as the diver must always be within the bell, and his head of course in the upper part, the inventor has contrived, that even there, when he has breathed the hot air as well as he can, he may, by means of a spiral copper tube *bc*, placed close to the inside of the bell, draw the cooler and fresher air from the lowermost parts; for which purpose a flexible leather tube, about two feet long, is fixed to the upper end of the copper tube; and to the other end of this tube is fixed an ivory mouth-piece, by which the diver draws in the air, at the same time expiring by the nostrils. This bell may be supplied with fresh air by barrels, the same as Dr Halley's.

The next improvements introduced in the construction of the diving-bell were those by Mr Spalding of Edinburgh, and for which the Society of Arts voted him a reward. These are certainly deserving of attention, although they do not appear to have afterwards been adopted in practice. Mr Spalding had, in the two preceding years, acquired considerable experience in the management of a bell on Dr Halley's plan, which he had constructed in the hopes of recovering some of a considerable property which had been lost in a ship wrecked on the Scares, or Fern Islands, in 1774, in the night, when all the crew perished. Some of the light goods were thrown on shore, and it was proposed to recover the rest by diving, the remainder of the owners giving up the management of the whole to Mr Spalding. His first experiments were made in depths of five, six, and eight fathoms, in Leith Roads; and having in these made his apparatus

Diving-
Bell.Spalding's
of trials in Dr
Halley's
bell.

Diving-
Bell.

tolerably perfect, he sailed for Dunbar, thirty miles distance, in an open long boat, sloop-rigged, and of about six or eight tons burthen. By a mistaken account he had been informed the bottom of the Fox ship of war lay there; but upon his arrival, the oldest seaman in the place could give him no intelligence; and as that vessel had perished in the night with all on board, somewhere in Dunbar Bay, and by storms, so long before as thirty years, it was thought to be sanded up. In order to gratify the curiosity of some friends there, he still determined to descend where it might be thought probable her bottom lay; but in seven and eight fathoms water he found nothing but a hard sandy bottom, from which he was led to conjecture that the proprietors of the valuable effects which were on board that vessel might have found their account in sweeping for her. Being informed that a vessel, which was thrown up by accident in the river Tay, near Dundee, with a large quantity of iron, lay within two fathoms of the surface at low water, he determined to make trial there, and accordingly sailed across the frith to that place, about fifteen leagues distant from Dunbar. Here he went down three different times, changing the ground at each going down, and at last fell in with a stump of the wreck, sunk five fathoms deep at low water to a level with the soft bed of the river, which is composed of a light sand intermixed with shells. The principal parts of this wreck were supposed to have been carried away by an immense body of ice the year before. He found that the muddiness of the river occasions a darkness at only two fathoms from the surface that cannot be described; and from the smallness of his machine, which contained only forty-eight English gallons, it was impossible to have a candle burning in it, which would consume the air too quickly for any man to be able to work, and at the same time pay attention to receiving the necessary supplies of air.

These trials were only preparatory to his views at the Scares, hoping to acquire experience which would enable him to surmount the dangerous difficulty of the unequal rocky bottom which he expected to meet with; but in the preceding trials, and different alterations of the machinery, so much time had been lost, that the weather became stormy, and he was obliged to wait at Bamborough Castle some time till the weather became more favourable. He then sailed to the Scares with his brother, three sailors, and two pilots. It was four in the afternoon, about high water, when he went down at a small distance from the place where he judged the wreck to lie. The depth was about ten fathoms. He fortunately alighted on a flat part of the rock, within a small space of a dreadful chasm, and had just gone two steps with his machine, when the terror of the two pilots was so great, that, in spite of his brother, they brought him up very precipitately, before he had in any degree examined around him. On coming into the boat, they remonstrated on the danger of the machine being overturned either on the wreck or the rocks, and also on the impossibility of raising any of the weighty goods with so small a purchase in an open boat, and in a place where, at this season, no large vessel would venture to lie, as the nights were then so long, and only two passages for a small vessel to run through, in case of a gale of easterly or southerly wind; one of the passages being extremely narrow, and both of them dangerous.

"Convinced from this," says Mr Spalding in his account, "that with an open boat nothing could be accomplished, and that, except in June and July, no man would risk himself with me in a sloop, to continue a few days and nights at anchor there, I was obliged to abandon my project; yet I determined to take a view of the guns of a Dutch ship of war lost in the year 1704; and as they lay

two or three miles nearer the land, I could execute this design with less difficulty, especially as the weather continued still favourable. Having procured all the intelligence possible, we went to the place, where I went down four different times, but could find no marks of any wreck, notwithstanding my walking about in five and six fathoms water, as far as it was thought safe to allow the rope to the bell, continuing generally twenty minutes each time at the bottom. On this occasion I was obliged to carry a cutting hook and knife, and clear away the sea weeds, which at this place are very thick and strong; without this method I could not move about. At the fifth going down, each trial being in a different place, I was agreeably surprised to find a large grove of tall weeds, all of them from six to eight feet high, with large tufted tops, mostly in regular ranges, as far as the eye could reach, a variety of small lobsters and other shell-fish swimming about in the intervals." He then discovered the place where one of the cannons lay; but was too much exhausted, by having been down at intervals for near three hours, to attempt bringing it up.

In these descents Mr Spalding found out two very serious dangers attendant on the use of the bell on Dr Halley's plan. These are, 1. By Dr Halley's construction, the sinking or rising of the bell depends entirely upon the people who are at the surface of the water; and as the bell, even when in the water, has a very considerable weight, the raising of it not only requires a great deal of labour, but there is a possibility of the rope breaking by which it is raised, and thus every person in the bell would inevitably perish. 2. As there are, in many places of the sea, rocks which lie at a considerable depth, the figure of which cannot possibly be perceived from above, there is danger that some of their ragged prominences may catch hold of one of the edges of the bell in its descent, and thus upset it before any signal can be given to those above, which would infallibly be attended with the destruction of the people in the bell, especially as it must always be unknown, before trial, what kind of a bottom the sea has in any place.

To obviate these defects, Mr Spalding introduced a balance-weight suspended below the bell, and which, when it reached any rocky or uneven ground, settled down first, and then the bell being made too light to sink without the weight, remained suspended and free from danger; and for the purpose of raising or levelling the bell without aid from above, he divided with an air-tight partition the upper portion of the bell from the lower. The former was capable of being filled either with water or air at pleasure, and of thus increasing or diminishing the buoyant effect at pleasure, on the same principle as the air-bladder in fishes.

Plate CLXXXIX. fig. 7, represents these arrangements, which will be understood from the following description: ABCD represents a section of the bell, which is made of wood; *ee* are iron hooks, by means of which it is suspended by ropes QBF*e*, and QAER*e*, and QS, as expressed in the figure; *cc* are iron hooks, to which are appended lead weights, that keep the mouth of the bell always parallel to the surface of the water, whether the machine, taken altogether, is lighter or heavier than an equal bulk of water. By these weights alone, however, the bell would not sink; another is therefore added, represented at W, and which can be raised or lowered at pleasure by means of a rope passing over the pulley, and fastened to one of the sides of the bell at M. As the bell descends, this weight, called by Mr Spalding the *balance-weight*, hangs down a considerable way below the mouth of the bell. In case the edge of the bell is caught by any obstacle, the balance-weight is immediately lowered down, so that it

Diving-
Bell.

Diving-Bell.

may rest upon the bottom. By this means the bell is lightened, so that all danger of oversetting is removed; for, being lighter without the balance-weight than an equal bulk of water, it is evident that the bell will rise as well as the length of the rope affixed to the balance-weight will allow it. This weight, therefore, will serve as a kind of anchor, to keep the bell at any particular depth which the divers may think necessary; or, by pulling it quite up, the descent may be continued to the very bottom.

By another very ingenious contrivance, Mr Spalding rendered it possible for the divers to raise the bell, with all the weights appended to it, even to the surface, or to stop at any particular depth, as they might think proper; and thus they could still be safe, even though the rope designed for pulling up the bell was broken. For this purpose the bell is divided into two cavities, both of which are made as tight as possible. Just above the second bottom EF, are small slits in the sides of the bell, through which the water entering as the bell descends, displaces the air originally contained in this cavity, which flies out at the upper orifice of the cock GH. When this is done, the divers turn the handle G, which stops the cock; so that if any more air was to get into the cavity AEFD, it could no longer be discharged through the orifice H, as before. When this cavity is full of water, the bell sinks; but when a considerable quantity of air is admitted, it rises. If, therefore, the divers have a mind to raise themselves, they turn the small cock g, by which a communication is made between the upper and under cavities of the bell. The consequence of this is, that a quantity of air immediately enters the upper cavity, forces out a quantity of the water contained in it, and thus renders the bell lighter by the whole weight of the water which is displaced. Thus, if a certain quantity of air is admitted into the upper cavity, the bell will descend very slowly; if a greater quantity, it will neither ascend nor descend, but remain stationary; and if a larger quantity of air is still admitted, it will rise to the top. It is to be observed, however, that the air which is thus let out into the upper cavity must be immediately replaced from the air-barrel; and the air is to be let out very slowly, or the bell will rise to the top with so great velocity that the divers will be in danger of being shaken out of their seats. But, by following these directions, every possible accident may be prevented, and people may descend to great depths without the least apprehension of danger. The bell also becomes so easily manageable in the water, that it may be conducted from one place to another by a small boat with the greatest ease, and with perfect safety to those who are in it.

Instead of wooden seats used by Dr Halley, Mr Spalding made use of ropes suspended by hooks bbb, and on these ropes the divers may sit without any inconvenience. I and K are two windows made of thick strong glass, for admitting light to the divers. N represents an air-cask with its tackle, and NP the flexible pipe through which the air is admitted to the bell. In the ascent and descent of this cask the pipe is kept down by a small weight appended, as in Dr Halley's machine. F is a small cock by which the hot air is discharged as often as it becomes troublesome. Fig. 5 is a representation of the whole diving apparatus, which it is hoped will be readily understood without any further explanation. Two air-barrels are represented in this figure; but Mr Spalding was of opinion that one air barrel capable of containing thirty gallons is sufficient for an ordinary machine.

An improvement has been suggested on Mr Spalding's plan of raising or lowering the bell, by shutting up the upper bell entirely, and forming it into a magazine of condensed air, which being charged by two air-pumps within

the bell, could be let off at pleasure, and filling the lower bell, would displace the water and increase the buoyancy.

The last great improvement on the diving-bell, and what stands next in importance to that of Halley, and has brought the machine to that perfect state in which it is now so successfully employed, was introduced by the celebrated engineer Mr Smeaton. This consisted in substituting for the air-barrels of Halley a forcing air-pump, by which a continued stream of air was poured into the bell without any farther trouble or apparatus than a man or two to work the pump. It was about the year 1779, in the repairs of the foundations of Hexham Bridge, that Mr Smeaton first tried the use of the diving-bell; and this was the first attempt indeed to introduce it into the operations of engineering, where it has since rendered such essential service. The piers of the bridge having been undermined by the violence of the current sweeping away the gravel from under the floor timbers of the caissons by which they were founded, it occurred to Smeaton that by means of the diving-bell the cavities under the foundations might be filled up with rough stones, rammed and wedged firmly together. His diving-bell consisted of a square box or chest of wood, three and a half feet long, two feet broad, and four feet high. The pump for supplying it with air was fixed on the top of the bell, and worked by a handle at one side. The depth of the river being small, it was not intended to go down so as to cover the whole of the bell, else the air-pump would have required to be removed; it was only necessary to sink the mouth of the bell down to the level of the caisson bottom. With the assistance of this machine Mr Smeaton succeeded in underpinning the foundations of some of the piers. The calamitous accident which followed in 1782, when the whole structure was carried away by a sudden and violent flood, only proved the great insufficiency of the natural bed of the river.

In 1788 Mr Smeaton constructed a second diving-bell, for the operations contemplated at Ramsgate harbour, on a much more substantial and improved plan; and this is the model on which all the succeeding diving machines have been formed. Instead of the usual form of a bell or conical inverted tub of wood, sunk by weights attached to the outside, this consisted of a square chest of cast iron, four and a half feet long, four and a half feet high, and three feet wide, affording sufficient room for two men at a time to work under it. Instead of the weights applied externally, the bell itself was cast of such thickness, particularly at the bottom, that its own weight, viz. fifty cwt., was more than sufficient to sink it when full of air. The pump also for supplying fresh air was placed in a boat by itself, on which several hands were stationed, to keep the pump continually in action. The air from the pump was conveyed to the machine by a flexible tube, which allowed the bell to be moved up or down, or in any direction, independent of the motion of the boat. From the above dimensions, the bell would always contain about fifty cubic feet of air, which, from what we have already shown, would be sufficient to support life for two persons for about an hour, independent of any supply from above; so that any idea of danger from this source is completely removed. It was in clearing the foundations for the advanced pier at Ramsgate that it occurred to Mr Smeaton the operation might be facilitated by the diving-bell. A large quantity of stones had been thrown in, to secure the old pier head; and it seemed doubtful whether they could be got up in nine and ten feet water by the usual method of tongs from the barges. The diving-bell was found to answer completely the object intended. In the course of two months the foundations were cleared; and it was computed that of 160 tons of stone raised out of the foun-

Diving-Bell.

Last great improvement in introduction of an air-pump by Smeaton.

Trial at Hexham Bridge.

Operations at Ramsgate harbour.

Diving-Bell.

ation, about 100 stones, many of them above a ton each, were brought up by the diving-bell, without which a full season would have been lost.

The pier, which was afterwards built on the foundation thus cleared, was founded by caissons, but in the course of years was found to require renewal in some places, and in others to be protected by an apron or outside wall of regularly-built masonry; and here a new application of the diving-bell arose in the building of this wall under water. For this purpose the bell is suspended by powerful tackle to the extremity of a long wooden frame, which rests on the top of the pier, the one end projecting over the pier, and the other running back and turning on a centre pin, which is fixed in a heavy stone on the pier. The frame thus sweeping with a long radius, and the weight of the whole being borne by a roller running along near the edge of the pier on a cast-iron plate or rail in the segment of a circle, the bell is capable of having a considerable motion right or left along the wall, and the block of the tackle being moveable along the frame, the bell is by this means shifted out or in from the wall at pleasure; and by these two motions can be set in any required position within the sweep of the apparatus. The directions for moving it are given by the divers, and communicated to those who have charge of the apparatus above, by merely striking with a hammer on the inside of the bell. From the great facility with which water conducts sound, the strokes of the hammer are heard at a great distance, and have a peculiar character, which is not easily mistaken for any other. To convey various directions, the divers have established a sort of language from the number of blows of the hammer. One blow, for instance, denotes more air; two, stand fast; three, heave up; four, lower down; and so on. The first operation in the building is to clear and level the foundation. If this be loose materials, they are removed by dredging, in the usual manner; but wherever rock occurs, it is done by the bell, with two men in it, being let down to the bottom, which, at Ramsgate, is a hard chalk rock. When it stands thereon, it lays the chalk dry to the level of the bottom edge of the bell; but if the surface is uneven, the bell cannot descend so low but that it will leave six or eight inches of water on the bottom. The surface of this water is the level they work to, and by cutting away every eminence which rises above the water, they soon obtain a perfectly level surface. They work with a small pick, made something like a narrow adze, for this purpose; and the work proceeds rapidly, for the chalk is not very hard. When they have accumulated as much rubbish as becomes inconvenient, they give three knocks on the bell to order the people to draw it up, till they, standing on the bottom, find themselves knee deep; then two knocks to stand fast. They now take in a shallow basket which has been previously let down from above, and fill the rubbish into it, then snatch it to order it to be drawn up, and strike four times on the bell, that they may be lowered down to proceed with their work. Having in this manner hewed away the surface till the water, standing equally all over it, shows it to be a perfect level plane, they give orders to be removed to a new situation, yet at such a small distance that part of the surface they before levelled is still beneath the bell, in order that both may be brought to one plane. Thus continuing the work, they get all the rock prepared for the stone-work, without any other level than the water.

The foundation being thus levelled, the stones are in the mean time all prepared and jointed, either square or with dovetails. These are first hoisted from the pier by means of a crane, and let down to their places in the work, as nearly as can be done, by the crane. As each stone is thus laid, the divers direct themselves right or

left, up or down, until they be exactly over the stone; then making fast a strong chain to the lewis of the stone, the other end of which is attached to a ring in the top of the bell, they give the signal to heave, and the bell, with the stone under it, are both suspended by the tackle, and being moved right or left until it cover exactly over its place in the wall, it is then let down, and the chain being detached, the operation proceeds with another stone in the same manner, until the wall be completed. No cement is generally used to unite the stones; their own weight, and the accuracy of the joints, being sufficient to hold them together.

Since the completion of Ramsgate harbour, the diving-bell has been applied with great success to various other operations of a similar kind in different parts of the kingdom, and particularly at Dublin, Donaghadee, and other harbours in Ireland, and at Holyhead and Portpatrick on this side the channel. Plate CLXXXVIII. contains drawings of the bell and machinery used for the harbour of Houth, near Dublin, under the direction of the late eminent Mr Rennie, and with which the foundations of the pier wall were laid with success at very considerable depths below water.

Fig. 1 is a section showing the machine and the bell viewed in the direction of the length of the wall which is to be erected, and fig. 2 is an elevation of the same as it appears when viewed from the sea. A is the bell, which is made of cast iron. It is suspended by strong chains passed through eyes *rr*, fig. 5, and through the ring *m* of a tackle B. FF, figs. 1 and 2, are strong beams supported in a horizontal position by cross beams G, resting at one end on the shore, and the other ends supported by a scaffolding L of piles firmly braced. On the beams F two iron railways are laid for the wheels of two carriages to run upon; one of these carriages contains the tackle which suspends the bell, and the other has a similar tackle to hoist the large stones, which are to be laid on the wall X. Each carriage runs with four wheels *aa* upon the railways F, and has a smaller or upper carriage running upon it in a transverse direction; and this upper carriage contains the windlass purchase tackle, by which the bell or the stone is raised. Thus F' is the timber frame of the principal carriage, on the top of which are railways for the wheels *dd* of the upper carriage, of which D is the frame; and C is the roller or barrel to wind up the rope or fall of the great purchase tackle B, which is suspended from the frame of the carriage, and bears the weight of the bell. On the end of the barrel is a large cog-wheel M, which is turned round by a pinion fixed on the axis N of a second wheel O, and this is turned by a pinion, to which the handles H are applied. By turning these, two men can raise or lower the bell with ease. In order to move the bell in either direction, the wheels *aa* of the lower carriage E are provided with cogs at one edge, and pinions *b* work in the teeth of these; both pinions *b* are fixed on the same axis, which extends across the frame; and wheels *c* are also fixed on each extremity of the axis. These wheels have holes or mortises in them to receive handspikes or levers, by which they can be turned round, and will then move the lower carriage and the bell along the railways FF, in the direction of the length of the wall, which is to be built as shown by X. In like manner the wheels *dd* of the upper carriage are provided with cogs and pinions *e*, on the end of which are the capstan head *f* to receive handspikes, when it is required to move the upper carriage and the bell in a transverse direction. By means of these two motions in transverse directions, the bell or the stone can be suspended over any required spot in the wall, and lowered down thereupon as the men in the bell direct. Fig. 5 is a section of the bell, and fig. 6 a

Diving-Bell.

Diving-bell employed in other places.

Account of bell and machinery at Houth, near Dublin.

Divinity. plan to show the apertures *nn* for the lenses which give light. Two men descend together, a seat *s* being fixed across on each side of the bell. The air-pipe is screwed on at *k*, and proceeds to the air-pump as shown in fig. 1. The pump is placed on the top of the scaffold *G*; it has two barrels *I I*, which are worked by a lever *K*, by one or two men; they act as forcing pumps, and the air which is thrown down escapes from the lower edge of the bell, and rises up through the water in bubbles. By this means the air in the bell is at all times quite fresh and pure.

The stones which are to be used in building the wall are prepared on shore, and fitted to each other. When all is prepared, these stones are lowered down the bank by a capstan to the position *w*. The rope of the machine is then attached, and by the aid of both ropes the stone is lowered down upon the wall. The divers then descend in the bell, and the two carriages are brought close together, by which means the bell will hang partly over the stone *W*, fig. 2, so that the men can guide it into its place on the wall *X*, and make signals to those above to direct them which way to move the stone, and where to lower it. The bell was also employed, in the first instance, to clear the foundation for the walls. It was then lowered quite down on the bottom, and the men worked the rock to a level surface. In many parts it was requisite to blast it with gunpowder. The divers bored the hole in the rock, and placed the powder in a tin cartridge, which was well secured in the hole, by running in small fragments of stone. A small tin pipe was affixed to the canister, long enough to reach up above the surface of the water. When all was prepared, the bell was drawn up out of the way, and a nail or other small piece of iron heated red hot was dropped into the tin pipe, thereby to descend to the powder.

Figures 3 and 4 represent a vessel which was fitted up under the direction of Mr Rennie, to carry a diving-bell of cast iron. This vessel was used in Plymouth Sound, and the bell was swept over the bottom to discover and take up old anchors, &c. The bell *A* is suspended over the bow of the vessel, by a strong tackle *q*, from the extremity of a pair of shears; that is, two masts *DB, DB*, fig. 4. The fall or rope of the tackle *q* is drawn up by a windlass at *C*. There is also another strong tackle *GH*, extended between the head of the mast *I* and the top of the shears *D*. This is drawn by the windlass *F*. The use of this is to raise the shears upright, and bring the bell on board.

A platform *S* is fixed on the deck to lower it upon when out of use.

The diving bell has lately been employed with success in improving the navigation of the Clyde between Glasgow and Greenock, by raising up and removing out of the bed of the river a number of large stones which obstructed the channel, and could not be so readily got out by any other means. The bell is constructed similarly to that in fig. 3, but instead of being let down at the end or side of the barge, has a well constructed in the middle of the vessel itself, in which it is made to rise and fall by strong chains, tacklings, and cranes. Recently a second barge and bell have been constructed, and are now employed on the river for the same purpose. The management of the vessel and bell requires six or seven hands. The whole can be moved with great facility to different parts of the river, and moored wherever their assistance is required.

Such, then, is an account of the construction and uses of the different diving machines, and particularly the diving-bell; and we have no doubt that the principle, as it is susceptible of it, may yet be still more extensively applied, and in various other ways. The only disadvantage attending the machine in its present form is the expense and cumbrous nature of the apparatus, which prevents its use in many cases where it might be of real service; so that it is only in some great and extensive public work that it can ever be thought of. It is to be hoped, therefore, that the skill and ingenuity of our mechanicians may yet succeed in introducing the machine in a more accessible and manageable form.

See Halley, *Phil. Trans.* 1716, vol. xxix. p. 492, also vol. xxxi. p. 177; Triewald, *Phil. Trans.* 1736, vol. xxxix. p. 377; Spalding, *Transactions of the Society of Arts*, vol. i. p. 220; Klingert, *Phil. Mag.* vol. iii. p. 172; Lawson, *Phil. Mag.* vol. xx. p. 362; Bushnell, *Transactions of the American Philosophical Society*, vol. iv. p. 303; *Repertory of Arts*, vol. xv. p. 383; Nicholson's *Journal*, vol. iv. p. 229; Healy, *Phil. Mag.* vol. xv. p. 9; Robertson, *Phil. Trans.* 1757, p. 30; Franklin's *Works*, letter lv.; Leopold's *Theatrum Pontific.* tom. i. ii. xxvi.; Borelli and Mersenne, in Hooke's *Phil. Collections*, No. ii. p. 36; Bachstrom's *Kunst zu schwimmen*, Berlin, 1742; Bazin, *Hamb. Mag.* i. iii. and xxi.; Gelacy, *Mém. de l'Acad. Par.* 1757; and Coulomb, *Recherches sur les moyens d'exécuter sous l'eau Travaux Hydrauliques.* (c.)

DIVINITY properly signifies the nature, quality, and essence of God.

DIVINITY is also used in the same sense with theology.

DIVISIBILITY, that property by which the particles of matter in all bodies are capable of separation or disunion from one another.

As it is evident that body is extended, so it is no less so that it is divisible; for since no two particles of matter can exist in the same place, it follows that they are really distinct from each other; which, indeed, is all that is meant by being divisible. In this sense the least conceivable particle must still be divisible, since it consists of parts which are really distinct. To illustrate this by a familiar instance, let the least imaginable piece of matter be conceived lying on a smooth plain surface; it is evident the surface will not touch it everywhere, and those parts, therefore, which it does not touch may be supposed separable from the others, and so on as far as we please. And this is all that is meant when we say that matter is infinitely divisible.

All that is supposed in strict geometry, says Mr MacLaurin, concerning the divisibility of magnitude, amounts

to no more than that a given magnitude may be conceived to be divided into a number of parts equal to any given or proposed number. It is true that the number of parts into which a given magnitude may be conceived to be divided is not to be fixed or limited, because no given number is so great but a greater may be conceived and assigned; but there is not, therefore, any necessity for supposing the number of parts actually infinite; and if some have drawn very abstruse consequences from such a supposition, yet geometry ought not to be loaded with these.

How far matter is actually capable of being divided, may in some measure be conceived from this, that a piece of wire gilt with so small a quantity as eight grains of gold, may be drawn out to a length of 13,000 feet, the whole surface of it still remaining covered with gold. We have also a surprising instance of the minuteness of some parts of matter in the nature of light and vision. Let a candle be lit and placed in an open plain, it will then be visible for about two miles round; and consequently, were it placed two miles above the surface of the earth, it would fill with luminous particles a sphere four miles in diameter, and this before it had lost any sensible part of its weight.

Divisibility.
Diving-bells on the Clyde.

Division. A quantity of vitriol being dissolved, and mixed with nine thousand times as much water, will tinge the whole; consequently it will be divided into as many parts as there are visible portions of matter in that quantity of water. There are perfumes which, without a sensible diminution of their quantity, will fill a very large space with their odorous particles, which must therefore be of an inconceivable smallness, since there are a sufficient number in every part of that space sensibly to affect the organ of smelling. Dr Keill demonstrates, that any particle of matter, how small soever, and any finite space, how large soever, being given, it is possible for that small particle of matter to be diffused through all that space, and to fill it in such a manner as that there shall be no pore in it whose diameter shall exceed any given line.

The chief objections against the divisibility of matter in *infinitum* are, that an infinite cannot be contained by a finite; and that it follows from a divisibility in *infinitum*, either that all bodies are equal, or that one infinite is greater than another. But the answer to these objections is easy; for the properties of a determinate quantity are not to be attributed to an infinite considered in a general sense; and who has ever proved that there could not be an infinite number of infinitely small parts in a finite quantity, or that all infinities are equal? The contrary is demonstrated by mathematicians in innumerable instances.

DIVISION, in general, is the separating a thing into two or more parts.

Mechanical DIVISION signifies that separation which is occasioned in the parts of a body by help of mechanical instruments. The mechanical division of bodies does indeed separate them into smaller, homogeneous, and similar parts; but this separation cannot extend to the primary integrant molecules of any body, and consequently it is incapable of breaking what is properly called their *aggregation*; also, no union is formed betwixt the divided and dividing bodies, in which respect division essentially differs from dissolution.

Division is not properly a chemical operation; it is, in fact, only employed preparatorily, in order to facilitate other operations, and particularly solution. For this purpose it is very useful, as it increases the quantity of surface, and consequently the points of contact, of any body. Different methods are used to divide bodies according to their nature. Those which are tenacious and elastic, as horns and gums, require to be cut, rasped, or filed. Metals, because of their ductility, require the same treatment; but as they are also fusible, they may be quickly and conveniently reduced into grains small enough for most operations, by pouring them, when melted, into water. All brittle bodies may be conveniently reduced into fine parts by being bruised in a mortar with a pestle. Very hard bodies, such as glass, crystals, and stones, particularly those of the vitrifiable kind, before they are pounded, ought to be plunged when red hot into water, by which means they are split and cracked, and rendered more easily pulverable. Bodies of this kind may also be bruised or ground by means of a hard and flat stone, upon which the matter is to be put, and bruised by another hard stone so small as to be held and moved upon the larger stone with the hand. The larger stone is called a *porphyry*, from its being generally of that kind of stone; and the operation is called *porphyzation*. Instead of porphyzation, a mill may be used, composed of a hard grit millstone, moving round upon another stone of the same kind, which must be fixed; in the upper stone is a groove or channel through which the matter to be ground passes. By this method a substance may be more quickly reduced to a fine powder than by porphyzation. But these mills can be only employed for considerable quantities of matter.

These methods of mechanically dividing bodies are attended with some practical inconveniences, the most considerable of which is, that some parts of the dividing instruments are always struck off and mixed with the matter to be divided. This may greatly affect the operations; for instruments of iron and copper furnish metallic colouring particles, and copper is very prejudicial to health. Porphyry is coloured by a reddish-brown matter, which injures the colour of crystal glasses, enamels, and porcelains made with matters ground upon this stone. These matters, therefore, must be cleansed after their porphyzation, or else no instruments capable of injuring the intended operations ought to be employed. Thus, for the preparation of all medicines to be taken internally, no copper instruments, as mortars, pestles, or the like, should be used, those made of iron being preferable; and mortars, grinding stones, and mill-stones, made of hard and white stones, ought to be employed, instead of those made of porphyry, for substances which are to enter into the composition of enamels, crystal glass, and porcelain, the whiteness of which is a most necessary quality.

DIVISION, in *Algebra*. See **ALGEBRA**.

DIVISION, in *Arithmetic*. See **ARITHMETIC**.

DIVISION of an Army, in the military art, two or more brigades under the command of a general of division.

DIVISION, in sea affairs, a number of ships in a fleet or squadron of men of war, distinguished by a particular flag or pendant, and usually commanded by a general officer. A squadron is commonly ranged into three divisions, the commanding officer of which is always stationed in the centre.

DIVORCE, a breach or dissolution of the bond of marriage.

Divorce was allowed of in great latitude both amongst the Pagans and Jews. In Rome, barrenness, age, disease, madness, and banishment, were the ordinary causes of divorce. Under the consulship of M. Attilius and P. Valerius, Spurius Carvilius was the first who put away his wife because she was barren; though Plutarch, in his Roman Questions, maintains that Domitian was the first who permitted divorce. Justinian afterwards added impotence, a vow of chastity, and the profession of a monastic life, as valid reasons of divorce.

The Roman lawyers distinguish between *repudium* and *divortium*; the former being the breaking of a contract or espousal, and the latter separation after matrimony. Romulus enacted a severe law, which forbade a wife to leave her husband, but gave the husband the liberty of turning away his wife, either upon her poisoning her children, counterfeiting his private keys, or committing the crime of adultery; if the husband, however, put her away on any other occasion, he ordered one moiety of his estate to be settled on the wife, and the other to be given to the goddess Ceres, besides an atonement to the gods of the earth. In later times, however, the women as well as the men might sue a divorce. The common way of divorcing was by sending a bill to the woman, containing the reasons of separation, and the tender of all her goods which she brought with her, and this was called *repudium mittere*; or else it was performed in her presence, and before seven witnesses, accompanied with the formalities of tearing the writings, refunding the dowry, taking away the keys, and turning the woman out of doors.

The Grecian laws concerning divorce were different. The Cretans allowed divorce to any man who was afraid of having too many children. The Spartans seldom divorced their wives, and it was extremely scandalous for a woman to depart from her husband. The Athenians allowed divorce on very trivial grounds. It proceeded by a bill, containing the reason of the divorce, and approved,

Division
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Divorce.

Divorce. if the party appealed, by the chief magistrate; and women also were allowed to leave their husbands on just occasions. Persons divorcing their wives were obliged to return their portions, otherwise the Athenian laws obliged them to pay nine oboli a month for alimony. The terms expressing the separation of men and women from each other were different; the men were said *αποπεμπειν* or *απολειπειν*, to dismiss their wives; but wives, *απολειπειν*, to leave their husbands.

"The law of Moses," observes Archdeacon Paley, "for reasons of local expediency, permitted the Jewish husband to put away his wife; but whether for every cause, or for what cause, appears to have been controverted amongst the interpreters of those times. Christ, the precepts of whose religion were calculated for more general use and observation, revokes this permission, as given to the Jews 'for their hardness of heart,' and promulgates a law which was thenceforward to confine divorces to the single cause of adultery in the wife: 'Whosoever shall put away his wife, except it be for fornication, and shall marry another, committeth adultery; and whoso marrieth her which is put away, doth commit adultery.'

"Inferior causes may justify the separation of husband and wife, although they will not authorize such a dissolution of the marriage contract as would leave either at liberty to marry again; for it is that liberty in which the danger and mischief of divorces generally consist. The law of this country, in conformity to our Saviour's injunction, confines the dissolution of the marriage contract to the single case of adultery in the wife; and a divorce even in that case can only be brought about by the operation of an act of parliament, founded upon a previous sentence in the spiritual court, and a verdict against the adulterer at common law; which proceedings taken together compose as complete an investigation of the complaint as a cause can receive. It has lately been proposed to the legislature to annex a clause to these acts, restraining the offending party from marrying with the companion of her crime, who by the course of proceeding is always known and convicted; for there is reason to fear that adulterous connections are often formed with the prospect of bringing them to this conclusion; at least, when the seducer has once captivated the affection of a married woman, he may avail himself of this tempting argument to subdue her scruples and complete his victory; and the legislature, as the business is managed at present, assists by its interposition the criminal design of the offenders, and confers a privilege where it ought to inflict a punishment. The proposal deserved an experiment; but something more penal, it is apprehended, will be found necessary to check the progress of this alarming depravity. Whether a law might not be framed, directing the fortune of the adulteress to descend as in case of her natural death; reserving, however, a certain proportion of the produce of it, by way of annuity, for her subsistence (such annuity in no case to exceed a certain sum); and also so far suspending the estate in the hands of the heir as to preserve the inheritance to any children she might bear to a second marriage, in case there was none to succeed in the place of their mother by the first; whether such a law would not render female virtue in higher life less vincible, as well as the seducers of that virtue less urgent in their suit, I would recommend to the deliberation of those who are willing to attempt the reformation of this important but most incorrigible class of the community. A passion for splendour, for expensive amusements and distinctions, is commonly found in that description of women who would become the subject of such a law, not less inordinate than their other appetites. A severity of the kind proposed applies immediately to that passion; and there is no room

for any complaint of injustice, since the provisions above stated, with others which might be contrived, confine the punishment, so far as it is possible, to the person of the offender; suffering the estate to remain to the heir, or within the family of the ancestor from whom it came, or to attend the appointments of his will.

"Sentences of the ecclesiastical courts, which release the parties *a vinculo matrimonii*, by reason of impuberty, frigidity, consanguinity within the prohibited degrees, prior marriage, or want of the requisite consent of parents or guardians, are not dissolutions of the marriage contract, but judicial declarations that there never was any marriage; such impediment subsisting at the time as rendered the celebration of the marriage rite a mere nullity. And the rite itself contains an exception of these impediments. The man and woman to be married are charged 'if they know any impediment why they may not be lawfully joined together, to confess it; and assured, 'that so many as are coupled together, otherwise than God's word doth allow, are not joined together by God, neither is their matrimony lawful; all which is intended by way of solemn notice to the parties, that the vow they are about to make will bind their consciences and authorize their cohabitation only upon the supposition that no legal impediment exist."

By the law of Scotland, a divorce may be obtained on the ground either of adultery or of wilful desertion; but neither of these grounds dissolves the marriage *ipso jure*; and if a process of divorce be not instituted, the marriage subsists, notwithstanding the adultery or desertion. Until recently the action of divorce proceeded before the commissaries of Edinburgh; and in every such action, whether founded on adultery or desertion, the pursuer must make oath that the action is not collusive. The legal effect of divorce on the ground of desertion is, that the offending party loses the "tocher," as it is called, and the *donationes propter nuptias*; that is, the offending husband is bound to restore the dowry, and to pay or make good to the wife all her provisions, legal or conventional; and the offending wife forfeits her dowry, and all that would have come to her had the marriage been dissolved by the predecease of her husband. It is now held that recrimination is not a good defence against divorce for adultery; yet, as the mutual guilt may affect the patrimonial interests of the parties, it may be stated in a counter-action. But *lenocinium*, or the husband's participation in the profits of his wife's prostitution, may even the husband's connivance in her guilt, is a good defence to the wife against an action of divorce on the ground of adultery. The statute 1600, c. 20, declares marriages contracted between the adulterer and the person with whom he or she may be found, by the sentence of divorce, to have committed the crime, to be null and unlawful, and the issue of such marriages to be incapable of succeeding to their parents; but the act, nevertheless, has not the effect of bastardizing such issue. The right to institute a divorce is personal to the husband or wife; but if, after the action has been raised, either party die before the decree of divorce becomes final, it has been argued that the natural dissolution of the marriage by death supersedes and definitively closes all proceeding commenced for dissolving it on any other ground. The natural dissolution, it has been contended, is the first effectual one, and that which is to regulate all questions as to the patrimonial rights or the *status* of the survivor. But the question how far litiscontestation in such a case renders it transmissible to representatives, has not yet, we believe, been decided.

By the law of England there are two kinds of divorce, the one total and the other partial; the one *a vinculo matrimonii*, the other merely *a mensa et toro*. The total

Divus
||
Djebail.

divorce must be for some of the canonical causes of impediment, and these existing *before* the marriage, not supervenient or arising afterwards; for in cases of total divorce the marriage is declared null, as having been absolutely unlawful *ab initio*. Divorce *a mensa et toro* is when the marriage is just and lawful *ab initio*, but, for some supervenient cause, as in the case of adultery in either of the parties, it becomes impossible for them to live together. But in England adultery is only a cause of separation from bed and board; because, according to the law of that country, if divorces were allowed to depend upon a matter within the power of either of the parties, they might become extremely frequent, and the stability of society might in consequence be shaken. However, divorces *a vinculo matrimonii* have latterly been frequently granted by act of parliament; though, in order to prevent such from being obtained by fraud and collusion, the two houses not only examine witnesses in order to be convinced of the adultery of the wife, but they also require that the husband shall have obtained a sentence of divorce in the spiritual courts, and a verdict with damages in a court of law against some one who has had criminal intercourse with the wife. But this is not a standing order of the House of Lords; it is merely adopted as a rule of caution, and, in particular circumstances, it may therefore be dispensed with.

In connection with this subject a most important question has arisen, and can scarcely be said to be yet determined, namely, whether an English marriage can be dissolved by a Scottish court, when the parties have come within its jurisdiction. This question has been decided in the negative by the English, and in the affirmative by the Scottish judges. The ground taken by the English courts was, that an English marriage was by its nature indissoluble, and that as the *lex loci contractus* regulates other contracts, so it ought to regulate this. But in the Scottish courts it was contended, with much apparent force, that, in such a question as this, the *lex loci* must prevail over the *lex loci contractus*, and that the principle of *comitas* between the two countries, as well as public policy, requires that this doctrine should be recognised and admitted. The question, however, being one of great difficulty and nicety, we abstain from giving any opinion in this place concerning it.

DIVUS, DIVA, in *Antiquity*, appellations given to men and women who had been deified, or placed in the number of the gods.

Hence it is that upon medals struck on the consecration of an emperor or empress, they have the title of *divus* or *diva*; thus, DIVUS JULIUS, DIVO ANTONINO PIO, DIVO PIO, DIVO CLAUDIO, DIVA FAUSTINA AUG. and so on.

DIXMUYDEN, a city, having been formerly fortified, in the province of West Flanders, and circle of Furnes. It is situated on a rich soil on the river Yser, and the butter is considered the best in Flanders. It has 2563 inhabitants.

DIZIER, St, a city of the department of the Upper Marne, in France, on the river Marne. It is a fortified place, well built, situated in a pleasing district, and contains 816 houses, and 5640 inhabitants, some of whom find employment in building vessels from wood, which is abundant near to the city.

DJEBAIL, a town of Syria, situated on an eminence near the sea, two miles north of the river Ibrahim, which is crossed by a bridge of a single arch, fifty paces wide, and of light architecture. The Arabs established themselves here under the caliphate of Omar, and it is conjectured that the bridge was built by them. The crusaders in 1100 took possession of the town, which, after some vicissitudes,

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remained subject to them during their sway in the East. There was formerly a harbour, now almost obliterated. This town occupies the site of the ancient Biblos. The population is 6000.

DJEZIZA OMELMELECK, a sandy islet of the Red Sea, two miles from the Arabian shore. Here a singular bank is seen, in which all stages of petrification are observed in the course of a few feet from the sand. It is calcareous, and exceedingly white. The island is covered with plants. Lat. 25. 15. N.

DJIDEIDA, a town of Arabia, in the province of Hedsjaz, situated in a valley. The houses are very low, and constructed of stone without cement. It is twenty-eight leagues east-south-east from Yeuboa.

DMITRIEW, a circle in the Russian government of Kursk, bounded on the north and west by Orel, on the east by Fatesch, and on the south by Lgow. It is watered by the rivers Swapa, Usoscha, and numerous small streamlets, and is very productive of corn, potatoes, and hops. The inhabitants are about 96,000, in two cities and 138 villages, with sixty-five churches. The capital is a city of the same name, situated on the Swapa, but does not contain more than 1000 souls. Long. 35. 44. E. Lat. 52. 7. N.

DMITROW, a circle in the Russian government of Moscow, bounded on the north by Twer, on the east by Wladimir, on the south-east by Bogorodsk, on the south-west by Swenigorod, and on the west by Klin. It extends over 980 square miles, or 619,520 English acres, of which nearly one half is covered with wood. It contains 58,240 inhabitants, living in one city and in 463 villages, distributed in seventy-five parishes. The capital is a city of the same name, situated on the river Jachroma, at its junction with the Neteka. It contains 594 houses, and 2950 inhabitants, who carry on some trade by the rivers that pass near it. Long. 37. 30. E. Lat. 56. 18. N.

DMITROWSK, a circle in the Russian government of Orel, south-east from that city. It is watered by the river Narusa, and consists chiefly of good arable land, which is celebrated for its production of hemp. The capital is a city of the same name, situated on the Oscheriza, which contains 600 houses and 3400 inhabitants. It was originally a colony of Greeks, Moldavians, and Wallachians, induced to settle here by Prince Kantem, to whom the land belonged, and it was first incorporated as a city in 1778. Long. 37. 12. E. Lat. 52. 25. N.

DO, in *Music*, a note of the Italian scale, corresponding to *ut* of the common gamut. See *MUSIC*.

DOAB. This term in Hindustan means any tract of country included between two rivers. It should properly include all the territory between the Jumna and the Ganges; but it is usually restricted to the southern portion of it, for the most part comprehended in the province of Agra. This country is of a fertile soil, and yields a large return to the cultivator. It produces mullet, sugar cane, and barley, and is peculiarly adapted for indigo, which grows here in a wild state. Tobacco has also been introduced by the Europeans, and thrives well. The climate during the rainy season is exceedingly hot, and during the winter is only cool in the morning. The country was once in a high state of cultivation; and the remains of former prosperity are everywhere seen amidst the extensive wastes and jungles which now occupy a large portion of the surface. The tranquillity which it has enjoyed under the dominion of the British is highly favourable to its improvement. By a treaty concluded with Scindia in 1803, the forts and territories of the Doab between the Jumna and the Ganges were ceded to the British; and the southern part of the Doab was ceded in 1801 by the reigning nabob.

DOABEH BARRY is a district of Hindustan, in the

Djeziza
Omelm-
leck
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Doabeh
Barry.

Dobberan
||
Dobuni.

province of Lahore, situated between the Beyah and Ravey rivers, and between the thirtieth and thirty-first degrees of north latitude. Doabeh Jallinder is a large district in the Darne province, between the Sutlege and Beyah rivers, and for the most part between the thirtieth and thirty-first degrees of north latitude.

DOBBERAN, a town in the duchy of Mecklenburg Schwerin, the capital of a district of the same name, which comprises two towns, three parishes, and several hamlets, with 8800 inhabitants. The town is a mile from the Baltic, and is much frequented by visitors, on account of its sulphureous natural baths, and for the advantage of sea-bathing. The reigning duke makes it his residence in the bathing season, and has constructed appropriate buildings for the accommodation of the company that resort to it. It is about six miles from Rostock. The regular residents are between 1400 and 1500, but the summer visitors more numerous.

DOBRUSHKA, or DOBRUSKA, a town in the Austrian kingdom of Bohemia, in the circle of Königingratz, the residence of the princes Colloredo. It has much trade in corn, flax, and yarn, which are largely sold at its weekly market. It contained, in 1819, about 400 houses and 1893 inhabitants.

DOBSCHAU, a town of Hungary, in the province of Hither Theis. It is situated on the banks of the Dobsina. It is the chief place of the mining district Rosneau, in which are extracted iron, copper, cobalt, and mercury. In the neighbourhood asbestos and granite are found. It contains one Catholic and one Lutheran church, with about 500 houses and 4000 inhabitants, mostly Germans, who find employment in manufacturing the metals.

DOBSON, WILLIAM, an English portrait and historical painter, born at London in 1610. He served an apprenticeship to one Peck, a stationer and picture dealer; and owed his improvement to the copying of some pictures of Titian and Vandyck, whose manner he always retained. He had further obligations to the latter of these artists; for it is said that a picture of his painting being exposed at a shop on Snow-hill, Vandyck, happening to pass by, was struck with it exceedingly, and having inquired after the author, found him at work in a poor garret. Vandyck had the generosity to equip him in a manner suitable to his merit. He presented him to King Charles I. who took him under his protection, kept him at Oxford all the time his majesty continued in that city, and not only sat to him several times for his own picture, but caused the Prince of Wales, Prince Rupert, and indeed most of the lords of his court, to do so likewise. Mr Dobson, however, being somewhat loose and irregular in his way of life, was far from improving the many opportunities he had of making his fortune, and died very poor, in 1647, at his house in St Martin's Lane.

DOBUNI, or BODUNI, an ancient people of Britain, who possessed the territory which now forms the counties of Oxford and Gloucester. Both the names of this British nation seem to have been derived from the low situation of a great part of the country which they inhabited; for both *Duon* and *Bodun* signify deep or low in the ancient language of Gaul and Britain. The Dobuni are not mentioned among the British nations who resisted the Romans under Julius Cæsar, which was probably owing to the distance of their country from the scene of action; and before the next invasion under Claudius, they had been so much oppressed by their ambitious neighbours the

Cattivellauni, that they submitted with pleasure to the Romans, in order to be delivered from that oppression. Cogidunus, who was at that time prince of the Dobuni, recommended himself so effectually to the favour of the Emperor Claudius, by his ready submission, and other means, that he was not only continued in the government of his own territories, but had some other states put under his authority. This prince lived so long, and remained so steady a friend and ally to the Romans, that his subjects, being habituated to obedience in his time, never revolted, nor stood in need of many forts or forces to keep them in subjection. This is certainly the reason why we meet with so few Roman towns and stations in the country anciently inhabited by the Dobuni. The Durocornovium of Antoninus, and the Corinium of Ptolemy, are believed by antiquaries to have been the same place, namely, the capital of the Dobuni, and situated at Cirencester, in Gloucestershire, where there are still many marks of a Roman station. Clevum or Glevum, in the thirteenth *iter* of Antoninus, stood where the city of Gloucester now stands; and Abone, in the fourteenth *iter*, was probably situated at Avinton on the Severn. The country of the Dobuni was comprehended in the Roman province *Britannia Prima*.

DOCETÆ (from *δοκεῖν*, to appear), in *Ecclesiastical History*, the followers of Julius Cassianus, one of the Valentinian sect, towards the close of the second century, who revived a notion which had been adopted by a branch of the Gnostics, against whom St John, Ignatius, and Polycarp, had asserted the truth of the incarnation. They, as their name imports, believed and taught that the actions and sufferings of Jesus Christ were not real, but only apparent.

DOCIMASIA, or DOKIMASIA, in Greek antiquity, a probation of the magistrates and persons employed in public business at Athens. It was performed publicly in the forum, where they were obliged to give an account of themselves and of their past lives before certain judges. Amongst the questions proposed to them was, whether they had been dutiful to their parents, had served in the wars, and had a competent estate.

DOCIMASTIC, or DOKIMASTIC, ART, a name given to the art of trying, by operations in small, the nature and quantity of metallic or other matters which may be obtained from mineral or other compound bodies.

DOCIMENUM MARMOR, a name given by the ancients to a species of marble, of a bright and clear white, which was much used in large and sumptuous buildings, such as temples and the like. It derived its name from Docimenos, a city of Phrygia, afterwards called Synaia, near which it was quarried, and whence it was conveyed to Rome. It was accounted little inferior to the Parian in colour, but not capable of so elegant a polish; and hence it was less used by the statuary, or in other smaller works. The Emperor Hadrian is said to have used this marble in building the temple of Jupiter; and many of the great works of the Romans are constructed of the same materials.

DOCK, in the manège, is used for a large case of leather, as long as the dock of a horse's tail, which serves it for a cover. The French call the dock *trousse-queue*. It is made fast by straps to the crupper, and has leathern thongs which pass between the thighs, and along the flanks of the animal, to the saddle straps, in order to keep the tail tight, and to prevent it from whisking about.

Docetæ
||
Dock.

DOCK,

Dock.

AN inclosed space for the reception of ships, either for their security or for the convenience of building or giving them repairs. This word has been derived by some, absurdly enough, from the Greek *δεχομαι*, to receive. That we had it, along with almost the whole of our sea-terms, from the northern continental nations, is sufficiently obvious. Thus in Flemish it is *dok*; Teutonic, *dock*; Swedish, *docka*; Suio-Gothic, *docka*; perhaps originally from *dekken*, to cover, protect, secure, inclose. The *dock* for inclosing the prisoner in a court of justice is evidently from the same origin.

Docks for the reception of ships are of two kinds, *wet* and *dry*.

A *wet dock* may either have gates to retain the water in it, so that ships shall constantly remain afloat, or be left open for the tide to flow into and ebb out of it at pleasure, either leaving it dry at low water, or with a certain depth of water remaining in it, according to its construction and situation with regard to the low-water mark, and to the ebbing of the sea at spring or neap tides. A wet dock, without gates, is generally distinguished by the name of a *basin*, which, however, is sometimes indiscriminately applied to a wet dock, whether with or without gates.

A *dry dock* either becomes dry by the ebbing of the tide when the gates are left open, or by shutting the gates at low water, and pumping out whatever water may remain in it at that time, by the power of men, horses, wind, or, which is now most commonly performed in the king's dock-yards, by the steam-engine.

A *wet dock*, therefore, may be defined to be "a basin of water, in which ships may be kept afloat at all times of the tide;" a *dry dock*, a "receptacle in which every part of a ship can be examined, and its defects repaired." Ships may also be conveniently built in dry docks, and floated out by opening the gates; though, in all dock-yards, there are places set apart for this purpose, under the name of *slips*. A wet dock is called by the French *un basin*; a dry dock, *une forme*; and a slip, *un calle*.

The digging out the earth, and building the surrounding walls of masonry to prevent the sides falling in, and the preparation of the mortar and puzzolana, in the construction of a wet dock, are attended with great labour and expense. The two wet docks or basins of Cherbourg (see *BREAKWATER*), which are probably the finest specimens that exist in the world, are estimated to have cost three millions sterling. The labour of excavation may sometimes be spared, and a series of wet docks or basins conveniently made by turning the course of a tide-river through an isthmus, and placing a pair of gates at each end of the old channel. In this way were the new docks of Bristol constructed out of the bed of the Avon.

Wet docks.

Wet docks are an improvement in navigation and commerce of the utmost importance, but of very modern date in this country; indeed, they owe their introduction entirely to a spirit of individual enterprise in commercial speculation. Liverpool might still have remained a poor fishing village but for its convenient docks, which not only produce to the town and corporation a large revenue, but ensure to the merchant every possible facility in refitting, loading, and discharging his ships, whatever their burden or their cargo may be, without being exposed to the risk of losing both ship and cargo in a rapid tide-river; and, at all events, to an unavoidable delay, occasioned by distance, the weather, or the state of the tides.

Hull is also greatly indebted for the extension of its

commerce to its docks. Its old wet dock contains an area of ten acres nearly, and has accommodated at one time 130 sail of such vessels as frequent that port.

London, though unquestionably the first city in the world for its opulence, its commerce, and public spirit, and possessing within itself the powerful internal means of supporting docks, and all other conveniences that trade and shipping may require on the most extensive plans; London has been the last to try the experiment of docks, except in the case of two spirited individuals, Mr Perry at Blackwall, and Mr Wells at Greenland Dock, both private ship-builders. Notwithstanding the total inadequacy of legal quays, which subjected the merchants to incalculable losses and delays, and in many cases proved absolutely ruinous; notwithstanding the effect of the heavy, expensive, and fatal embarrassments experienced regularly on the arrival of the West India fleets, and the annual losses, by plunder in the river, on West India produce, which alone were calculated to amount to L.150,000 to the proprietor, and L.50,000 to the revenue, and more than the double of those sums, including other branches of commerce; it was not till the year 1799 that prejudices and private interests were so far removed as to enable the merchants concerned in the West India trade to obtain an act of parliament to carry into execution a plan of docks, quays, and warehouses, for the convenience of that trade on the Isle of Dogs. Since that time the London Docks, St Katharine Docks, and various others, have been completed, to the incalculable benefit of the shipping interest and the commerce of the metropolis.

The docks of Liverpool were the first of the kind that were constructed in this kingdom, by virtue of an act of parliament passed in 1708; and from that period the town of Liverpool has rapidly raised itself from a poor fishing village, and a port for coasting vessels, to be the second commercial town and port in the empire; and the plan of improvements now carrying into execution for the enlargement and better arrangement of the docks will, when completed, render it, for convenience and appearance, in this respect the very first, not London even excepted.

It appears from a statement, apparently authentic, that in the ten years ending with 1808, the number of ships which entered these docks was 48,497, tonnage 4,954,204; and the dock duties received L.329,566; and that, in the following ten years ending in 1818, the number of ships was 60,200, the tonnage 6,375,560, and the amount of duties L.666,438. It may also be observed, that this extraordinary increase has taken place since the abolition of the slave trade, which, it was asserted, would be the ruin of Liverpool.

The docks of Hull have also been advantageous, though in a less degree, to the wealth and prosperity of this trading town. The docks at Leith afford security and convenience to the increased commerce of the capital of Scotland.

The *West India Docks* on the river Thames commenced in February 1800, and were opened in August 1802. They consist of an outward and a homeward-bound dock, and communicate by means of locks with a basin of five or six acres on the end next to Blackwall, and with another of more than two acres at the end next to Limehouse, both of which basins communicate with the Thames. The outward-bound dock is about 870 yards in length, by 135 in width, containing consequently an area of more than twenty-four acres; the homeward-bound dock is of the

Dock.

Dock. same length, and 166 yards in width, its area being little short of thirty acres; and the two together will contain with ease at least 500 vessels of from 250 to 500 tons. The whole are surrounded with a high wall, and, as a security against fire, the moment that a ship enters the dock the crews are discharged, and no person whatever is allowed to remain on board, or within the premises, the gates of which are closed at a certain hour. They are surrounded by immense warehouses, which are estimated to contain nearly 10,000 hogsheads of sugar, and an immense quantity of rum. The sum authorized by parliament to be raised for completing these docks and warehouses was L.1,200,000, and the total expense was probably not far short of one million and a half; yet on this capital the subscribers have been receiving from a very short period after their opening ten per cent., which, by the terms of the act, is not to be exceeded, and the term granted is limited to twenty-one years; but, like most other property, these docks have been greatly depreciated in value, and at present barely pay eight per cent.

The next set of docks that were undertaken for the advantage of the trade of the capital was the *London Docks*. These docks are situated in Wapping, and are appropriated for the reception of all ships arriving in the port of London with wine, spirits, tobacco, and rice on board, but not exclusively, ships having on board other cargoes being admitted, on the payment of certain fees. The act of parliament for incorporating the dock company was passed in 1800, authorizing them to raise a capital of L.1,200,000; but such was the number of houses to be purchased (we believe not less than twelve hundred) occupying the site of the dock, that this capital, by subsequent acts, was extended to L.2,200,000, the dividends on which are limited, as in the West India Docks, to ten per cent. The great dock is 420 yards in length, and 230 yards in width, covering an area of twenty acres. A basin of three acres nearly connects it with the river. The warehouses are very magnificent; and the tobacco warehouse is the grandest and most spacious building of its kind in the world, being capable of containing five and twenty thousand hogsheads of tobacco, and the vaults underneath as many pipes of wine. This single building, under one roof, is said to occupy upwards of four acres of ground. These docks were opened in February 1805.

The *East India Docks*, for the exclusive reception and accommodation of the East India ships, were the last in succession. The act for the incorporation of the company was passed in July 1803, authorizing them to raise a capital of L.200,000, which was afterwards increased to L.600,000, the dividend, as in the case of the two others, to be limited to ten per cent. These docks are situated at Blackwall. That for the reception of homeward bound ships is 470 yards in length by 187 in width, containing a surface of rather more than eighteen acres; the outward-bound dock is 260 by 173 yards, and is consequently something more than nine acres. An entrance basin of three acres nearly, and a spacious lock, connect them with the Thames.

Dry docks. A dry dock, requiring to be perfectly water-tight, demands the greatest care in its construction. It is sometimes lined all round with wood, but more generally with masonry, mostly of hewn granite. The expense is very considerable, as the foundation, by means of piles or otherwise, must be well secured, all leakage prevented, and the culvers or drains properly constructed, to let in and carry off the water without its undermining the quays or piers. The cost of a complete dry dock will vary probably from L.20,000 to L.100,000, according to the size of the ships it is intended to admit, and the nature of the ground on

which it is to be constructed. A dry dock may be *single*, or made to contain only one ship; or *double*, to contain two ships; but the former is the most common, because most convenient.

As it is of the utmost importance to preserve the water in a wet dock, and to keep it out of a dry dock, it may be proper to describe the different kinds of *gates* which are in use for this purpose.

The most common, and on the whole, perhaps, the best and most convenient, are swinging gates, which open in the middle, and lie flat, one part against each wharf or side-wall of the passage leading into the dock or basin. The elevation of this kind of gate is represented in Plate CCIII. fig. 3. This kind of dock gate requires to be made of great strength, with sound timber and good iron, and the gudgeons on which the hinges turn to be well secured into the stone abutments. Care also must be taken to make the bottom of the passage and the bottom of the gates perfectly plane and parallel, to prevent leakage, and give facility to their opening and shutting, which is usually assisted by rollers fixed in a groove, and performed by means of a small capstern on each pier. Attached to the top of the gates is usually a foot bridge with railing, which, separating in the middle, opens and shuts with the gates.

The most simple, but by no means the most effective contrivance for keeping out the water, is the wicket-gate, of which the plan and elevation are represented in Plate CCIII. fig. 5 and 6. It consists of three parts, which, when opened, are removed separately. This gate is rarely made use of unless where the abutments are not sufficiently strong, or their foundation sufficiently secure, to bear the weight of a pair of swinging gates.

A third kind of gate consists of a floating dam or caisson, first introduced into this country by General Bentham, and first applied to the great new basin in Portsmouth dock-yard. They are built somewhat in the shape of a Greenland fishing-boat, sharp at the two ends, narrow, and deep in proportion to the depth of water at the entrance of the dock. The keel fits into a groove at the bottom of the passage, and the two slanting ends rise and fall in corresponding grooves cut into the two abutments. Of this kind of gate, fig. 1 and 2, Plate CCIII. represent the plan and elevation. By letting in the water, the caisson sinks in the grooves, and acts as a closed gate; and by pumping out the water, or letting it out to a certain depth, the dam floats as the tide rises, and the narrow part, rising to the top, is readily disengaged from the grooves, and easily floated away as a boat. The advantages of these floating dams, as stated by General Bentham, are, that they are cheaper of construction than the gates heretofore in use for closing docks or basins; that they occupy less space, are more easily repaired, and one and the same dam is capable of being used, as need may require, in different places at different times. These caissons have also the advantage of serving as bridges of communication for loaded carriages across the entrances they close, and they require much less labour than gates in opening or shutting up passages into docks or basins, since their occasional buoyancy may be obtained without pumping water or unloading ballast.

Fig. 7 represents a plan, and fig. 4 a sectional elevation, of a dry or graving dock, into which ships are taken to have their defects examined and repaired, coppered, &c. and in which, if necessary, as already observed, ships may be built.

When a ship is brought into a dry or graving dock, she gradually subsides as the water flows out, till her keel rests upon the line of square blocks which are placed to receive it along the middle for the whole length; and on

Dock.

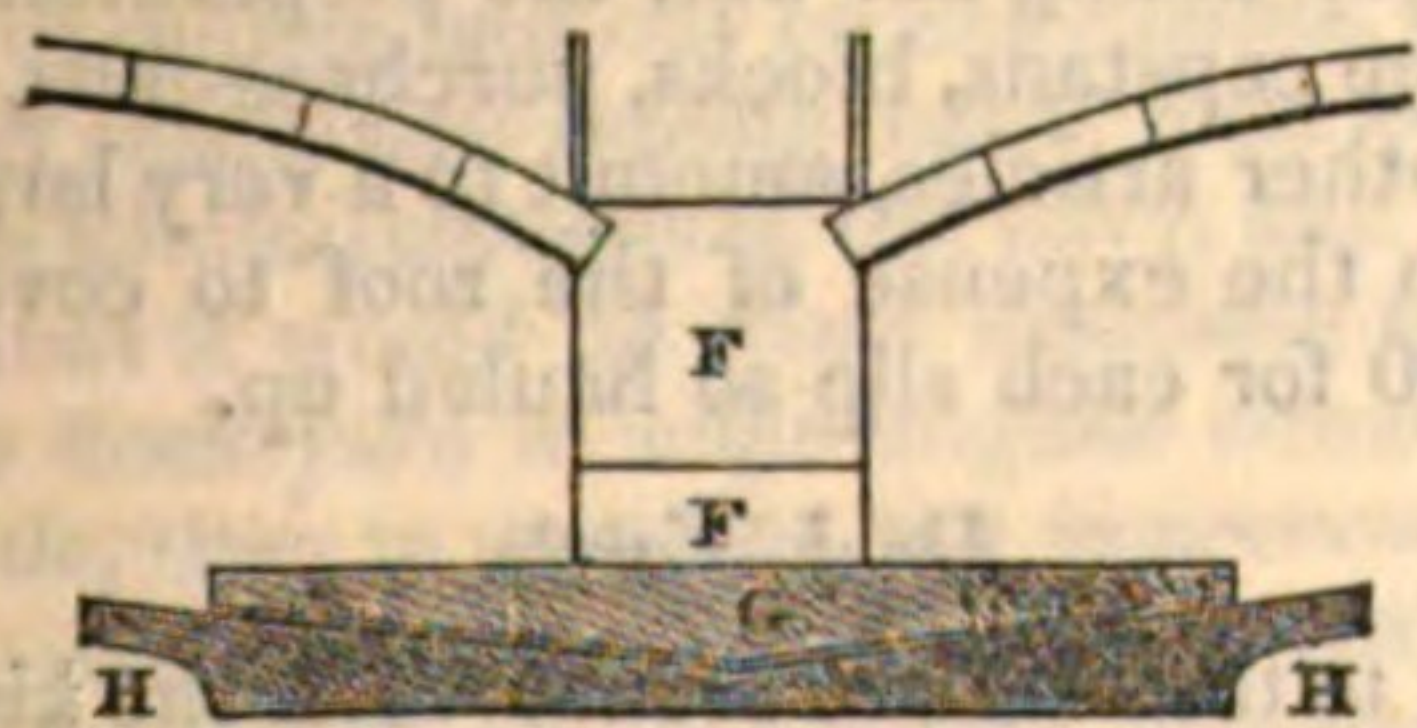
Dock gates.

Docking a ship.

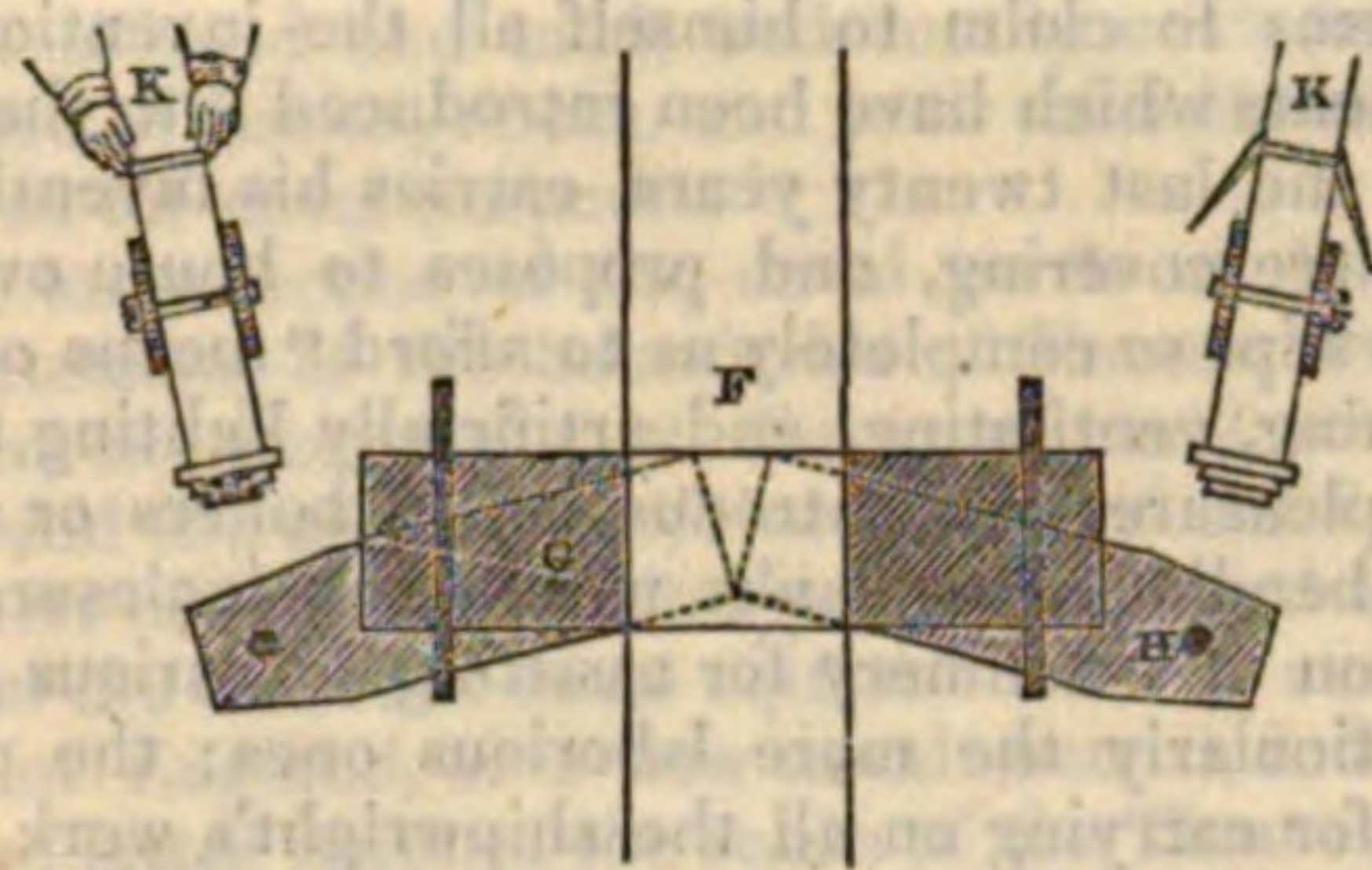
Dock. these blocks she is kept steady and upright by a number of shores or poles on each side, one of their ends being placed on the *altars* or steps of the dock, the other under the ship's bends and bottom. As a ship under repair generally requires something to be done to the main or false keel, or at any rate these parts require to be inspected, sometimes to shift the main keel, or to add to the whole length of the false keel, it was always found necessary in such cases to remove the blocks in order to get at the bottom of the ship; but this operation could not be performed without the more serious one of first *lifting* bodily the ship clear of all the blocks, and suspending her as it were in the air. This process was performed by driving wedges simultaneously under the ends of all the shores that supported the ship; an operation that required from four to five hundred men to enable them to suspend a ship of the first rate. When the *San Josef*, a large three-decker, required her bottom to be examined in 1800, the assistance of almost every artificer in the dock-yard was found necessary to perform this process of lifting her; nor was this the only inconvenience; the ship, thus suspended, suffered very material injury by the pressure of her own enormous weight against the ends of the shores that supported her, such as forcing in her sides, straining the knees and all her fastenings, breaking the treenails, &c.

To remedy these glaring inconveniences and very serious injuries that ships thus placed were apt to sustain, and to effect a saving of time and expense in the operation, Mr (now Sir Robert) Seppings, then master shipwright, and afterwards surveyor of the navy, contrived, sixteen or eighteen years ago, an improvement, as ingenious as it is simple, by which twenty men will suspend the largest ship in the navy, or rather, which amounts to the same thing, will disengage any one block that may be required, in the space of two or three minutes, without the necessity of suspending her at all; and, as a first rate in dock sits upon about fifty blocks, these twenty men will clear her of the whole of these blocks in about two hours; and as the saving of a day in completing the repairs of a ship is frequently the saving of a whole spring tide, the docking and undocking of a ship may make, and frequently has made, by this new method, the difference of a fortnight in the time of equipping her for sea.

The block of Mr Seppings, instead of being one solid piece, consists of three wedges, or, more properly speaking, of one obtuse wedge and two inclined planes, which, when put together and placed under the ship's keel, appear as under, when viewed in the direction or line of the keel,



where *G* is the wedge on which the keel rests, having its obtuse angle equal to 170° , and *HH* are the two inclined planes, each having an acute angle of 5° . The wedge is of hard wood, having its two sides lined with iron; the two inclined planes are of cast iron. When one of these blocks is to be disengaged from under a ship's bottom, nothing more is required than a few smart blows alternately on the two sides of the two inclined planes, when they fly out, and the middle part or wedge drops; and the facility of thus disengaging any of the blocks is in proportion to the quantity of pressure upon that block. The strokes are usually given by a kind of catapult or battering-ram, being a thick spar or pole moving on a pair of wheels, as *KK*.



This simple contrivance to get at any part of a ship's bottom by removing in succession all the blocks, without the necessity of lifting the ship, which the removal of any one block required to be done by the old method, is now universally adopted in all the dock-yards; and the lords of the admiralty marked their sense of the great utility of the improvement, by bestowing on Mr Seppings a reward of L.1000 for the invention.

Another very material improvement, recently introduced into his majesty's dock-yards, is that of covering the dry docks and building slips with roofs. The rapid decay of our ships of war by that species of disease known by the name of the *dry rot*, attracted very general attention; its effects were well known, but a variety of opinions were entertained as to its causes and its cure. It was quite obvious, however, that exclusion of air and moisture were the two great operating causes in giving activity to the progress of the disease (see *DRY ROT*); and that a ship in dock, stripped of her planking, and open to the weather in every part, alternately exposed to frost, rain, wind, and sunshine, must at least have her timbers differently affected, some swelled and water-soaked, others shrunk with heat, and others rifted with the wind and frost; and, if closed up with planking in this state, might be expected, at no great distance of time, to exhibit symptoms of decay. The workmen, too, in the open docks or slips, suffered from the vicissitudes of the weather no less than the ships, and their labour was frequently suspended, to the great detriment of the naval service. The measure of roofing over the docks and slips had long and repeatedly been suggested, but, either from prejudice or a false economy, it was only very recently carried into practice, but is now almost universal in all the yards. These roofs are generally constructed so as to be capable of having the sides and ends occasionally closed, according to the quarter from which the wind may blow; and by this contrivance the timber is prevented from rifted, as it is liable to do, by the action of a thorough draught of wind, and the health of the artificer is prevented from injury. The light is admitted through numerous windows placed in the roof. These roofs are in general supported on a row of wooden pillars, and covered with slate, some with plates of iron, and others with shingle. Plate CCIII. fig. 8, exhibits the transverse section of a roof thrown over the head of the dock at Plymouth, in which the *Foudroyant* is repairing; its span, from *A* to *A*, being 95 feet 4 inches, and the extreme width, from *B* to *B*, 125 feet 4 inches, supported, on the principle of trussing, without a single beam. Another of the same kind was built over the *Prince Regent* at Chatham, whose span was 100 feet, and the extreme width 150 feet. These immense roofs were constructed after a plan of Mr Seppings. The cost of one of the dimensions above mentioned was from L.6000 to L.7000, which, great as it may appear, must be amply repaid by the superior quality and durability of the ships built under it; but the same roof, with little or no repair, will, in all probability, serve as a covering for eight or ten different ships in succession. General Bentham, who, in his statement of *Services rendered in the Civil Department of the*

Dock.

Navy, seems to claim to himself all the inventions and improvements which have been introduced into the dock-yards for the last twenty years, carries his invention beyond a mere covering, and proposes to house over the docks and slips so completely as to afford "means of heating, warming, ventilating, and artificially lighting the interior at pleasure; the introduction of boilers or steam-kilns for bending the planks within the inclosure; the introduction of machinery for assisting in various operations, particularly the more laborious ones; the providing room for carrying on all the shipwright's work within the building; besides a variety of lesser works, such as it is found very inconvenient during the building or repairing of a ship to have executed, for example, in a smith's or carpenter's shop at a distance." Such buildings would not only be enormously expensive, but, in the present crowded state of the dock-yards, utterly impracticable. With regard to the invention of covered docks and slips, they have been used in Venice from time immemorial; and it appeared, from the evidence given by Mr Strange, the consul at that port in the year 1792, before the commissioners of land revenue, that two-and-twenty large ships had been under covered slips, some of them for sixty years nearly. At Carlsrona, also, there are several covered docks, and both Mr Nicholls and Mr Snodgrass strongly recommended the building of ships under cover nearly thirty years ago.

Hauling
up ships on
slips.

Among other experiments which have recently been making in the dock-yards for facilitating and expediting the repairs of ships, one may be mentioned, of which many persons are sanguine enough to think that the successful result is likely to be attended with most important benefits to the naval service. It is that of hauling up ships of war, of any dimensions, on building slips, instead of taking them into docks. It is no uncommon practice, at various ports of this kingdom, where there are neither artificial basins nor natural harbours, to haul vessels of the burden of fifty to two hundred tons, or probably larger, upon the beach, by means of capstans, to give them repairs; in like manner, most of the large fishing smacks are hauled up for security in tempestuous weather; but the practicability of hauling up ships of war, especially of the larger classes, was a matter of some doubt. Several frigates had, at various times, been hauled upon slips, when the docks were all occupied; and the ease with which the operation was performed induced the officers of the dock-yard to propose the hauling up of a line-of-battle ship. The *Kent*, of 74 guns, was selected for this purpose. It was necessary, in the first place, to take her into a dock, to have proper bilgeways prepared, and to be stripped, so as to be made as light as possible, her weight being, according to a calculation made from the water she displaced when afloat, about fourteen hundred tons. To heave up this weight fourteen capstans were employed, and the number of men to work these were as under:

Nine men to each bar and swifter.....	1512
Eight men to hold on at each.....	112
Three men to each capstan, to attend the fall.....	42
Men on board the ship, and employed in other } operations	450
Total of men employed.....	2116

The time occupied in hauling her up, after all the purchases were brought to bear, was forty minutes. The expense of preparing her, and the loss and wear and tear of the materials, was estimated at somewhere about L.2000.

The advantages which slips are supposed to possess over dry docks are many and important. They can be constructed at one twentieth part of the expense; they oc-

cupy less space; they can be constructed on a steep or a shelving shore; and ships can be hauled upon them either in spring or neap tides; whereas a dry dock can only be made in particular situations, and, when made, ships can only be docked and undocked in certain states of the tides; from which circumstance a considerable delay and inconvenience are frequently experienced. It should be recollected, however, that a large ship must necessarily go into a dock preparatory to her being hauled up on a slip.

It has been considered as not at all impossible, as was suggested some time ago by Mr Perring, the ingenious clerk of the check in Plymouth dock-yard, that the whole ordinary may hereafter be laid up on slips, which, if housed over, would unquestionably be the best means of increasing their durability, and preserving them from partial decay. Nor is it certain that in the end it would not be the most economical mode of preserving them. The expense, as appears from the *Estimates of the Ordinary of the Navy* for the year 1817, is L.187,000 for harbour victuals, harbour moorings and riggings, &c. besides L.135,000 for wages; the chief part of both which sums is on account of ships of war laid up in ordinary, none of which would be required by placing them on slips. It would indeed form a singular revolution in naval management, if ships hereafter should be laid up in ordinary on dry land, whilst the timber of which they are built is now considered to be the best preserved under salt water; a process which, from some experiments recently made, promises fair to be the most effectual prevention of, and a probable cure for, the dry rot. (See DRY ROT). This method of preserving timber has long been practised at Brest, Carthage, and several other places on the Continent; and the only objection to it in some of our ports appears to be the attack of the worm known to naturalists by the name of *teredo navalis*, whose bite is almost as destructive as the dry rot.

On the other hand, there are very many and serious objections, even were the measure practicable, of hauling up ships of the line in particular, to be laid in ordinary on slips. In the first place, the length of sea-beach which would be required is greater than probably all the dock-yards in the kingdom could furnish. Secondly, the three warrant-officers who are now employed in each ship, and who are the best men in the service, being no longer necessary, would be turned adrift, and, in all probability, utterly lost to the navy. Thirdly, no large ship could be hauled on the slips without being previously taken into a dock to have her bilgeways fitted, and her bottom prepared for placing her on the slip. The time taken for this purpose must necessarily interfere with the other works of the yard; and after taking her out, the preparations for heaving her up, the capstans, blocks, purchase-falls, chains, and a variety of other articles, amount to a very large expense, not less, with the expense of the roof to cover the ship, than L.10,000 for each slip so hauled up.

Dock-Yards.

Previously to the reign of Henry VIII. the kings of England had neither naval arsenals nor dock-yards, nor any regular establishment of civil or naval officers to provide ships of war, or to fight them. They had admirals, however, possessing a high jurisdiction and very great power. (See the article ADMIRAL). And it would appear, from a very curious poem in *Hacklitt's Collection*, called *The Policie of Keeping the Sea*, that Henry V. had both ships, officers, and men exclusively appropriated to his service, and independently of those which the Cinque Ports were bound, and the other ports were occasionally called upon, to furnish, on any emergency. By this poem it also appears that Little Hampton, unfit as it now is, was the port at which Henry built

Dock-
Yards.

Dock-
Yards.

.....his great *Dromions*
Which passed other great shippes of the commons.

But what these *dromions* were no one can now tell; nor is it easy to conceive how the building and repairing of the Great Harry, which in the reign of Henry VII. was launched at Portsmouth, and cost £15,000, was managed, considering the very rapid strides made at once from the small Cinque Port vessels, manned with twenty-one men and a boy, to this enormous floating castle. At that time it is well known that they had no docks, nor even substitutes for them.

The foundation of a regular navy, by the establishment of dock-yards, and the formation of a board, consisting of certain commissioners for the management of its affairs, was first laid by Henry VIII., and the first dock-yard erected under his reign was that of Woolwich. Those of Portsmouth, Deptford, Chatham, and Sheerness, followed in succession; and the last, excepting the new and unfinished yard of Pembroke, was Plymouth, which was founded by William III.

From the first establishment of the king's dock-yards to the present time, most of them have gradually been enlarged and improved by a succession of expedients and make-shifts, which answered the purposes of the moment; but the best of them possess not those conveniences and advantages which might be obtained from a dock-yard systematically laid out on a uniform and consistent plan, with its wharfs, basins, docks, slips, magazines, and workshops, arranged according to certain fixed principles, calculated to produce convenience, economy, and dispatch.

Imperfec-
tions of the
king's
dock-yards.

Neither at the time when our dock-yards were first established, nor at any subsequent periods of their enlargement as the necessities of the service demanded, could it have been foreseen what incalculable advantages would one day be derived from the substitution of machinery for human labour; and without a reference to this vast improvement in all mechanical operations, it could not be expected that any provision would be made for its future introduction; on the contrary, the docks and slips, the work-shops and store-houses, were successively built at random, and placed wherever a vacant space would most conveniently admit them, and in such a manner as in most cases to render the subsequent introduction of machinery and iron railways, and those various contrivances found in the large manufacturing establishments of private individuals, quite impossible, even in the most commodious and roomy of his majesty's dock-yards.

Proposed
dock-yard
on the Isle
of Grain.

The want of a systematic arrangement in our dock-yards, independently of machinery, and the enormous expenditure of money laid out on expedients, were questions of frequent discussion among naval men connected with the various administrations of the navy, and it was thought by many that it would be more desirable to construct an entire new dock-yard in some eligible situation, on an extensive scale, than to continue the *improvements* in the old ones. For this purpose, so early as the year 1765, the attention of the naval administration appears to have been turned to the Isle of Grain in the river Medway, along the shore of which is a fine expansive sheet of deep water. A dock-yard thus placed, on a systematic plan, would supersede that of Chatham on one side and Sheerness on the other; but it was discovered on boring that the substratum was so loose and sandy as not to admit of a solid foundation. General Bentham, however, revived the project in the year 1800, which he seems to claim as his own, and painted the situation in such glowing colours, and as affording so many advantages for a grand naval arsenal, that the lords of the admiralty were induced to order a fresh set of borings to be taken. These were carried to the depth of sixty feet, and were everywhere found to

consist of sand and mud, and totally unfit for the construction of basins, docks, and such solid buildings as are required for naval purposes.

The imperfection of the naval yards to the eastward, the extension of the boundaries of France towards that quarter, the occupation of the great naval port of Antwerp, and the uninterrupted command of the Scheldt and the ports of Holland by that power, rendered an enlargement of the means of naval equipment in the eastern dock-yards of England, or a new naval arsenal, indispensable. For the latter purpose the banks of the Thames were considered, in every point of view, as preferable to those of the Medway, the entrance into the latter being narrow, and having a bar across it, on which, at low water of spring tides, there is only fourteen or fifteen feet of water; whereas the navigation of the Thames is at all times uninterrupted, excepting by the badness of the weather. It communicates directly with the great market-town of London, in which every description of stores, foreign and domestic, is accumulated; and the trade of the Thames is the great source from which the fleet is supplied with seamen. The marshy peninsula of Northfleet was considered by naval men, who had turned their attention to the subject, to possess every possible requisite for the establishment of a royal dock-yard on an extensive scale. It was sufficiently removed from the mouth of the river to be completely sheltered, yet near enough for ships to proceed to sea with one wind. In the river between Northfleet and the sea there is plenty of water for the largest three-deckers to proceed with all their guns, ammunition, stores, and provisions on board, and almost with any wind, if moderate. A copious stream of good fresh water runs across the peninsula. The soil afforded plenty of earth suitable for bricks; the foundation was excellent for docks, slips, wharfs, and buildings of all kinds. It was sufficiently near the metropolis for speedy communication with the naval departments, and to receive stores in barges and the river craft. It was capable of being defended both on the land and river side; and when the whole was raised to the height of twelve feet with a dry gravelly soil, from the excavations of the docks and basins, there could be no doubt of the healthiness of the situation. By the direction, therefore, of the lords of the admiralty, a complete survey was made by Messrs Rennie and Whidbey, who furnished a plan and estimate of a naval arsenal on a magnificent scale, within which all kinds of machinery were proposed to be employed for the making of anchors, sawing of timber, rope-making, block-making, &c.; iron railways to be laid from the timber wharfs to the timber fields, from thence to the mills and pits, and from them to the docks, slips, and workshops. The estimate, it appears, was about six millions sterling, which Mr Rose, in his letter to the late Lord Melville, calculates, with the fortifications and unforeseen expenses, to amount actually to ten millions; an expense which the minister did not venture to propose, though there can be little doubt that, when the case was fairly stated to the public, and the necessity of increasing our naval establishments to the eastward had been made apparent, no violent opposition would have been made to a measure which tended to keep up our naval superiority, and which was the less objectionable, as none of the money would have been taken out of the country, but circulated within it, to the encouragement of the arts, trades, and manufactures of the kingdom.

The board of revision made a detailed report on the merits of the plan, which, however, as the execution of it was delayed, was not printed; but the real reason was supposed to be, the very gloomy view taken by the commissioners of the disadvantages and imperfections of the present dock-yards, which Mr Rose seems to think,

Dock-
Yards.

On the pe-
ninsula of
North-
fleet.

Dock-
Yards.

and indeed it is generally thought, is by no means warranted, and that those disadvantages in that report are greatly exaggerated, perhaps to enhance the value of the Northfleet plan, of which they seem to have been much enamoured. Imperfect as the old dock-yards are, chiefly from their having risen, as before observed, to their present state, by a succession of expedients and make-shifts, they are nevertheless far superior to any similar establishments on the Continent of Europe, if we except the unfinished arsenal of Cherbourg, whose magnificent basins (see BREAKWATER) are certainly unequalled, and the space surrounding them capable of being turned to every possible advantage. M. Charles Dupin, a French officer, who examined all our dock-yards with a skilful eye, pronounces them as by far superior to any on the Continent. We have heard much of the magnificent basins and the covered docks of Carlsrona, but the one has been greatly overrated, and the others are merely covered over with shed-like roofs; nor is there the least likelihood that the plan will ever be finished. We have been told likewise of the superior advantages of the naval arsenal of Copenhagen, where every ship has its appropriate storehouse. This plan has been adopted at Brest, and is reprobated there by every naval officer, and the officers of the yard, as most inconvenient, and a great waste of room, by having the most bulky and the most trifling articles stowed together in the same room. A better arrangement is that of having certain magazines appropriated to certain kinds of stores, and arranged according to the class or rate of ship for which they are intended, and, if appropriated or returned stores, the name of the ship to which they belong painted in front of the berth in which they are deposited. This is the system generally followed in our dock-yards.

The great point in which our naval arsenals are most defective is the want of wet docks or basins; which, however, are to a certain extent compensated at the two principal dock-yards of Portsmouth and Plymouth, by two magnificent harbours, in which the whole navy of England, when dismantled, may be moored and laid up in ordinary, in perfect security. The want of basins, however, in our dock-yards is most severely felt in time of war, when the expeditious fitting out of the fleet becomes so very desirable. One at Portsmouth on a small scale has been found of incalculable advantage to that yard; and a larger one, now constructed at Sheerness, will probably make that yard of sufficient capacity to supersede the necessity of a new establishment at Northfleet, or in any other situation to the eastward.

Idea of a
perfect
dock-yard.

The perfection of a dock-yard, then, independently of the advantages of machinery, which are but contingent, may be considered to depend upon one or more extensive basins, surrounded by spacious wharfs or quays. By means of these a prodigious saving of time, labour, and expense may be saved, in every stage of the progress of fitting out a ship for sea, from the moment she is launched from the slip, or taken out of a dock, as well as in dismantling a ship on returning to port to be paid off and repaired, or laid up in ordinary. For this purpose the docks and slips should occupy one of the sides of the basin, with working sheds for carpenters and joiners, smiths' shops, saw-pits, and seasoning-sheds between them. The ship, when completed on the slip and launched into the basin, may then be taken immediately into the adjoining dock to be coppered. From this she proceeds to the second side of the basin, in the corner of which is the ballast-wharf; the remainder of the side will probably be occupied by the victualling department, with appropriate stores in the rear for various kinds of provisions, and behind these the bakery, brewery, and slaughter-houses; on the wharf

the iron tanks for holding water, now universally used for the ground tier, in lieu of wooden casks. These are taken on board next after the ballast, and, together with the superincumbent casks, would be filled in the ship's hold by means of flexible pipes to convey the water into them. The provisions would at the same time be taken on board at the same wharf, in front of the victualling stores. The third side might be appropriated to the ordnance department, with the gun-wharf extending along the whole side, and the gun-carriage storehouses, magazines, &c. in the rear. The fourth side would be occupied as the anchor wharf, with the cable storehouses, the sail lofts and stores, rigging loft, and magazines for various stores, in the rear. Behind these, again, on the first side, containing the dry docks and building slips, the ground would be appropriated to the reception, birthing, and converting of timber, from whence iron railways would lead to the saw-mills, saw-pits, and work-shops, all of which would be placed on that side. On the second side a pond or basin for the victualling lighters and craft, with wharfs communicating with the manufactories and storehouses; the same on the ordnance or third side; and on the fourth side might be placed the ropery, hemp storehouses, tar-houses, with a basin for hemp-vessels, lighters, and the like. Communicating with the great basin on the building side, and also with the river or harbour, on the shore of which the dock-yard is to be formed, should be a mast-pond, with a lock for the storing of spars; in front the mast-houses, top-houses, capstan-houses, and a slip to launch the masts into the pond. Here also might be placed the boat-houses and boat-pond.

A peninsular situation like that of Northfleet, having at least three fourths of its shore surrounded with deep water, is peculiarly favourable for some such arrangement as is here mentioned; as any number of locks and canals might be made to communicate with the river, so that ships coming into the basin might not interfere with those going out, nor the lighters and other craft bringing their several species of stores, with either or with one another. By such an arrangement a ship would be equipped for sea at half the present expense, and within half the usual time. A ship fitting out for an anchorage distant from the dock-yard, as at the Nore and Spithead, is liable to every inconvenience and delay, as all her guns, stores, provisions, and water, must be carried to her in dock-yard lighters and other craft, into which and out of which they must be hoisted and rehoisted; liable to delay from bad weather and contrary winds; to be stove alongside the ship, to the total loss or damaging of their cargoes: added to which is the loss of time in going backwards and forwards, especially to the artificers; the desertion of the men; the accidents from the upsetting of boats; and many other evils of a magnitude not easily to be calculated, and exceeded only by the disappointment and vexation that unavoidably occur when ships are preparing for some particular and pressing service; all of which, when ships are fitted out in a basin for sea, are avoided. Here no delay, no embezzlement, no desertion, can take place. A ship in returning from sea may be docked and undocked into the basin with all her stores on board; and if to be paid off, instead of keeping the crew on board for weeks, till all the stores have been delivered into the dock-yard, the ship, by the proposed plan of basins, would remain securely in the basin, to be stripped at leisure by the riggers and labourers of the yard, and the crew become immediately available for other ships. Of the many superior advantages of wet docks for laying up ships to discharge, over the practice of exposing them in rivers or harbours, the shipping interest of the ports of London, Liverpool, Bristol, and Hull, can best testify, more espe-

Dock-
Yards.

Advan-
tages of a
systematic
dock-yard.

Dock-Yards. cially that of London, which has taken the precaution to surround the docks with high inclosing walls, by means of which all access is debarred, and all possibility of embezzlement prevented.

Royal dock-yards. From a brief description of the royal dock-yards as they now stand, a general idea may be formed of their several capacities, advantages, and defects. Taking them in succession, according to their vicinity to the capital, the first is

Deptford.—The front or wharf wall of this dock-yard, facing the Thames, is about 1700 feet in length, and the mean breadth of the yard 650 feet; the superficial content about thirty acres. It has three slips for ships of the line on the face next the river, and two for smaller vessels, which launch into a basin or wet dock, 260 by 220 feet. There are also three dry docks; one of them a double dock, communicating with the Thames, and the other a smaller one, opening into the basin. With these restricted means, even with an adequate number of workmen, its capacity for building ships, or for large repairs, must be very limited; but in the occasional repair of fourth-rates and frigates, and in the fitting out of sloops and smaller vessels, a great deal of work was performed at Deptford in the course of the war. The proximity of Deptford dock-yard to the capital is, however, of great importance, in the convenience it affords of receiving from this great mart all the home manufactures and products which may be purchased by contract for the use of the navy. It is, in fact, the general magazine of stores and necessities for the fleet, from whence they are shipped off, as occasion requires, to the home yards, the out-ports, and the foreign stations, in store-ships, transports, coasting sloops, lighters, and launches, according to the distance to which they must be sent, to the amount, in time of war, of more than 30,000 tons a year.

The principal stores deposited in Deptford dock-yard are small cordage, canvass, and ships' sails, to an immense amount; beds, hair for beds, hammocks, slops, and marine clothing; anchors under the weight of about seventy-five hundred, which are generally made by contract, all above that size being manufactured in the king's dock-yards.

The great magazines for the reception of these stores consist of a large quadrangular building, with a square in the middle, of three stories in height, with cellars underneath, in which are contained pitch, tar, rosin, and turpentine. The length of each side of these storehouses is nearly the same, differing from a square only by some eighteen feet: this length is about 210 feet, but they vary in width from forty-six to twenty-four feet.

Parallel to the west front of this quadrangle is the rigging-house and sail-loft, 240 feet, and nearly fifty feet wide, in which all the rigging is fitted for ships and stowed away, the sails cut out, made, and placed in proper births for their reception, as well as for various other stores of a smaller kind.

On the eastern extremity of the yard is a long range of building, called the pavilion, in which the beds, hammocks, and slop-clothing are kept, and in which also are the house-carpenters', the joiners', and wheelwrights' shops. This building is about 580 feet long by twenty-six feet wide.

The remaining buildings usually appropriated to the different services of a dock-yard are all to be found at Deptford; a good blacksmith's shop, a plumber, glazier, painter-shops, seasoning-sheds, store-cabins, saw-pits, mast-house, and pond, boat-houses, mould-loft, timber-births, besides good houses and gardens for the principal officers, with several coach-houses and stables, so that the whole space is completely filled up in every part.

The number of men employed in this yard, in time of war, may have been about fifteen hundred, of whom about one half were shipwrights and other artificers, and the

other half labourers. There were, besides, in constant employ, eighteen or twenty teams of four each, of horses, to drag timber and heavy stores. Deptford dock-yard has recently been put down.

Dock-Yards. Adjoining to the dock-yard is the victualling-yard, the Deptford completest establishment of the kind, perhaps, in this or any other kingdom, though still capable of much improvement in the arrangement. Its frontage to the Thames is about 1060 feet, and mean depth 1000 feet, containing about nineteen acres. This space is laid out in a more convenient manner than any of the dock-yards, for answering all the purposes which were intended. The general storehouses in front of the wharf wall, the cooperage, the brewery, the butchery, and the bakery, are all separate and complete in themselves. A mill has recently been erected, of such capacity as to grind corn to be made into biscuit sufficient for supplying the whole navy. Besides all the requisite offices for keeping the accounts, there are houses and gardens for eight of the principal officers of the yard; and when the old wharf wall shall have been repaired, and carried out a little farther into the river, for which a sum of L.27,000 appears on the estimate of 1817, the victualling-yard will be complete in all respects, according to the present arrangement. (*Navy Estimates for 1817.*)

The cooperage is spacious and well laid out. The staves are all sawed by hand, and this operation employs about 100 sawyers in time of war. Mr Brown of Fulham has succeeded, it seems, in making casks by machinery, by which seventeen men in nine hours are stated to be able to complete 300 casks, whereas, by the ordinary method, the same number could only complete about eighty. The brewery is well arranged, so is the bakery; and the butchery, consisting of a yard for keeping the cattle, with pens for sheep and hogs, two spacious slaughtering-houses, cutting and salting-houses, by the abundant supply of water and constant washing, are kept in the cleanest order, and free from any disagreeable smell.

In the salting season 260 carcasses have been slaughtered in each of the two days in the week appropriated to killing, and the hog hanging-house is capable of containing 650 carcasses.

The total number of coopers, sawyers, bakers, and labourers employed during war, in the victualling-yard at Deptford, amounted probably to twelve or thirteen hundred.

Woolwich Dock-Yard.—This first and most ancient of the dock-yards presents a frontage to the river of 3300 feet; the breadth is very irregular, being from 250 to 750 feet; and it contains an area of about thirty-six acres. It has five slips, which open into the river, three of which are for ships of the line, one for frigates, and one for vessels of a smaller class. It has three dry docks, one a double and one single dock, all of them capable of receiving ships of the line. With all its imperfections, Woolwich yard, with a complete establishment of artificers, has been of great service both in the building and repairing of ships of all classes. Some of the largest and finest ships in the navy have been launched from Woolwich yard, among which may be mentioned the Nelson and the Ocean. In fact, it is chiefly as a building yard that Woolwich ought to be considered as of much importance; and even in this respect it has of late years much deteriorated, owing to the increasing shallowness of the river, and the immense accumulation of mud, which is found in a very few weeks completely to block up all the entrances into the docks and slips, and along the whole length of the wharf wall. It is stated in the *Eighth Report of the Select Committee on Finance* (1818), that "the wharf wall at Woolwich, owing to the action of the tide on the foundation, is in a falling

Dock-Yards.

state, and in danger of being swept into the river, it being secured only in a temporary manner, and requires to be immediately rebuilt in a direction that will preserve it from similar injury hereafter, and prevent, in a great degree, that accumulation of mud which has, in the course of the last ten years, occasioned an expense of upwards of L.125,692, and would threaten in time to render the yard useless."

It was, in fact, found necessary to diminish the depth of the hold of the Nelson, in consequence of the Trinity Board having stated that no vessel drawing above nineteen feet of water could be navigated down to Erith Reach, and one even of that draught not without difficulty and danger.

The magazines or storehouses are not to be compared with those of Deptford. They are more confined, and, owing to the narrowness of the yard, and the progressive additions made according as necessity required, there is little or no methodical arrangement. As far, however, as regards the building and repairing of ships, its conveniences may be reckoned superior to those of Deptford. The new mast-houses and mast-slip, the new mast-ponds, and the houses for stowing yards, topmasts, &c. with the locks under them, are all excellent; and a new and spacious basin completes these great conveniences. The timber-births are well arranged, and the addition recently made to the western extremity of the yard will allow the stacking of several thousand loads of timber, and of classing it according to the purposes to which it may be applicable; and when the new smithery, and the line of wharf wall shall be completed, the dock-yard of Woolwich will become an important and valuable naval arsenal.

Ropery.

A considerable quantity of cables and cordage are manufactured at Woolwich; but the ropery is most inconveniently situated at a distance from the dock-yard, and great part of the town intervenes between them. Its length is 180 fathoms, but so narrow that the hemp storehouses, of three stories high, come close to the spinning house on either side. These storehouses are capable of containing about 2000 tons of hemp, and the cellars underneath them about 6000 barrels of pitch and tar. The hemp stores in the dock-yard are capable of containing about 2000 tons more.

In the present state and situation of the ropery, it would scarcely admit of the introduction of machinery, as has been done in most of the great private manufactories. The process of tarring, or passing the yarns through heated tar, and then drawing them through apertures in an iron plate, is performed at Woolwich by four horses. The laying of a cable of twenty-two or twenty-three inches is performed by the simultaneous exertion of 170 or 180 men, and requires upwards of an hour of the most severe exertion of strength, especially on the part of those who are stationed at the cranks, who not unusually break a blood-vessel by the severity of the labour. The simple and beautiful machine invented by the late Captain Huddart, performs with more accuracy the same process, and with the attendance of only three persons. For the reasons here stated, and the sufficiency of the other rope-yards, this at Woolwich has recently been disposed of.

Woolwich dock-yard seems to be complete in all the usual appendages of artificers, work-shops, store-cabins, offices for the clerks, houses and gardens for the commissioner and the principal officers of the establishment. The number of men employed during the war amounted to about 1800, of whom nearly 1100 were shipwrights and artificers, and the rest labourers. The number of spinners, knitters, layers, labourers, &c. in the ropery, might be about 260. Upwards of twenty teams of horses were daily employed in this yard.

One of the four divisions (the 4th, consisting of thirteen companies) of royal marines are stationed at Woolwich, where barracks and all the necessary buildings have been erected for their accommodation on shore. See the article MARINES.

Chatham Dock-Yard.—This dock-yard is situated on the right bank of the Medway, to which it presents a line of river wall at least 5500 feet in length; the width at the upper end being 400, in the middle 1000, and at the lower end about 800. The superficial contents may be estimated at about ninety acres. It has six building-slips on the front, from which ships are launched into the river; three of these are for ships of the line, and three for frigates and smaller vessels. In the same front are four dry docks communicating with the Medway.

The inconveniences arising from want of arrangement are less felt in Chatham than in any other of his majesty's dock-yards; and it could not perhaps be materially improved, if on the same site an entirely new dock-yard was to be planned. At the southern extremity of the yard is the ropery, hemp and yarn houses, rigging houses, a range of storehouses 1000 feet in length by about 50 in breadth, in front of which, along the wharf, are the anchor-racks, extending nearly 1000 feet. Next to these are the slips and docks, with the working-sheds and artificers' shops close in the rear, an excellent smithery, timber-births, seasoning-sheds, deal and iron yard, &c.; and beyond these, on the eastern extremity of the yard, the officers' houses and gardens. The commissioner's house and excellent garden are situated nearly in the centre of the yard. The lower or north-eastern part of the yard is occupied by mast-ponds, mast-houses and slips, store boat-houses and slips, ballast-wharf, timber-births, and saw-pits.

With all the advantages of interior arrangement, Chatham dock-yard still labours under that great defect to which most of the dock-yards are liable, from the injudicious manner in which the wharf walls have been constructed, without any regard being paid to the ebbing and flowing of the tide, or the currents of rivers, projecting in one part and retiring in others; the consequence of which is, that eddies are formed, and a constant accumulation of mud takes place along the line of the wall, and particularly in the openings of the dry docks, the slips, and the jetties. Of late years, however, since the attention of engineers has been called to this important subject, every opportunity is taken, in the repair of the wharf walls of the dock-yards, to correct the injurious effects arising from their improper direction; and as the river wall of Chatham is rebuilding, there is no doubt that due attention will be had to the line in which it is to be carried, so as to obviate the evil so universally complained of.

There is no wet dock or basin in Chatham-yard; but the Medway, flowing along it in a fine sheet of water, in some degree answers the purpose of one. The whole river might indeed be converted into a magnificent basin, by pursuing the same plan as that adopted in forming the new docks at Bristol. This would be effected by cutting a new channel for the river through the chalk cliff below Frindsbury Church, opening out a little above Upnor Castle, and continuing the new channel across the marsh near St Mary's Creek, so as to open out into Gillingham Reach close to the fort. Here a basin might be constructed wherein ships might be equipped in all respects ready for sea, whenever the wind and tide should be favourable. At present, owing to the shallowness of the water and the crooked navigation from Chatham round Upnor Point, they are obliged to take in their water and ballast at one place, their stores and provisions at another, their guns, powder, and ammunition at a third; in consequence of which, a ship is usually longer in getting out to sea from

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Chatham than even from Deptford. If this new channel was made for the river, the whole space from the first reach below Rochester Bridge to St Mary's Creek, at the lower extremity of the dock-yard, might be converted into one magnificent basin.

Chatham being a building, a repairing, and refitting yard, the establishment of men was much greater in war than at Woolwich or Deptford; the number of shipwrights and other artificers, and labourers, being probably upwards of 2000, besides those of the rope-yard, which might amount to about 250.

A considerable piece of new ground (about 2000 feet in length by 200 in breadth) has recently been added to the upper part of Chatham dock-yard, on which is erected one of the completest saw-mills in the united kingdom, under the direction of Mr Brunell. The mill is situated on high ground, and close to the margin of a deep circular basin or reservoir of water, dug down to the level of the Medway, with which it communicates by a tunnel or subterranean canal, passing through the mast-pond. From the side of the reservoir opposite to the mill proceeds a long iron railway, supported on a double row of iron pillars; and alongside of and parallel to this railway, on the side next to the dock-yard, are a continued series of stages for the reception of timber after it has been sawn into planks. A steam-engine of the power of thirty-six horses sets in motion all the operations of this mill, which may thus be briefly enumerated: *1st*, It drags up the large balks of timber through the canal into the reservoir as they are wanted. *2d*, It lifts up these large logs to the margin of the basin, carries them into the mill, and places them on the frame under the saws. *3d*, It saws them with the greatest nicety into planks of any required thickness. *4th*, It takes the pieces away thus sawn, and places them on carriages of iron. *5th*, It drives these carriages along the iron railway to any required distance. And *6th*, It deposits the sawn timber on the stages, ready to be used in any part of the dock-yard where it may be required. From these stages it is conveniently conveyed to the docks or slips by single horse carts or trucks, with great expedition, down an easy descent, and without the least interference with any of the works carrying on in the yard. The whole of these operations are conducted by about ten, or at most twelve men.

This mill is supposed to be equal to the power of fifty saw-pits and nearly one hundred sawyers, and is capable of supplying the dock-yards of Chatham and Sheerness with all the straight-sawn timber that they can require. But the great advantage of the plan is in its application of the steam-engine to the management and arrangement of timber, by which the labour and expense of a great number of horses are saved, and, what is of still greater importance, the obstruction and impediments to the general services of the yard are avoided, which the dragging about of large balks to and from the saw-pits, with teams of four horses each, occasions in all the other yards. It allows, besides, the large space of ground which these saw-pits would occupy, to be appropriated to other purposes.

The first division of royal marines, consisting of twenty-one companies, is stationed at Chatham, in excellent barracks, situated near to one of the extremities of the dock-yard. (See article MARINES.)

There is a small victualling depôt, situated partly in the parish of Chatham and partly in that of Rochester, from which the ships at Chatham and at Sheerness and the Nore receive a supply of provisions and water; but no articles of ship's stores are manufactured. The storehouses are sufficiently capacious for containing all the stores that can be required for the ships fitted out at the two ports on the Medway. The establishment consists of

an agent, clerk of the check, storekeeper, and their respective clerks, which, with the messengers, porters, labourers, &c. may amount to about ninety persons.

Sheerness Dock-Yard.—This dock-yard is situated on a low point of land on the island of Sheppey, whose soil is composed of sand and mud brought from the sea on the one side and down the Medway on the other, and has so much contracted the mouth of this river as completely to command the entrance of it. The situation, in a military point of view, is a most important one, particularly from its vicinity to the North Sea and to the anchorage at the Nore; by which anchorage, and the works of Sheerness, the mouths of the Thames and the Medway are completely defended.

As a situation for a dock, the objections to which it was liable are now in a fair way of being removed. On account of the low swampy ground on which it stood, fevers and agues were at one time so prevalent, that shipwrights and other artificers were literally impressed and compelled to work at Sheerness. In process of time, however, a town sprung up close to the dock-yard, and with it some little improvement by drainage, embankments, and other measures. Still it continued, till a very short time ago, an unhealthy and disagreeable place. As a dock-yard it was totally destitute of all convenience or arrangement; and the whole premises, mixed among wharfs and buildings belonging to the ordnance department, did not exceed fifteen acres of ground. The storehouses were dispersed in various parts of this space, and in so ruinous a state, that a ship hauled up in the mud was by far the best in the whole yard. It had two small inconvenient docks for frigates or smaller vessels. It was in fact a mere point of refitment, and might be considered as an appendage to Chatham.

From the very limited capacity of Sheerness, and the mighty preparations in the Scheldt, originated the magnificent project of the naval arsenal at Northfleet, which, from a change of political circumstances, and from the important improvements now carrying on at Sheerness, is not likely ever again to be revived. The Finance Committee (*Eighth Report*) say they have learnt "that the re-establishment and extension of the yards at Sheerness and Chatham may be considered as superseding, under any circumstance that can now be likely to occur, the plan contemplated for a naval establishment at Northfleet, on so extensive a scale as to require the expenditure of several millions."

These improvements appear indeed to be of sufficient magnitude to render any establishment at Northfleet wholly unnecessary, by making Sheerness, when finished, as complete a dock-yard, and perhaps more so, than any other in his majesty's dominions. Previously to carrying into execution this important undertaking, a committee of engineers and others was appointed, among whom were Watt, Huddart, and Jessop, whose plan was afterwards minutely examined, and some slight improvements suggested therein by Mr Rennie. The first stone was laid on the 19th August 1814, and the whole was completed at an expense not far short of one million sterling.

The advantages arising from the adoption of this plan are, *1st*, The addition of nineteen acres of ground to the dock-yard, by taking in the whole of the muddy western shore of the Medway, beyond the low-water mark of neap tides, and getting rid of the offensive and unwholesome smell which it perpetually occasioned. *2dly*, The construction of a wet dock or basin 520 feet in length by 300 in width, equal in surface to three and one half acres, and capable of containing a fleet of ten sail of the line, in which they can take on board all their stores, ammunition, and provisions, and be equipped in all respects ready to proceed to sea. The entrance into this basin is from

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the Medway, through a lock that is closed by a floating dam-gate. *3dly*, The construction of three dry docks on the eastern side of the basin, and opening into it, each capable of holding a first-rate ship of the line. *4thly*, Ample space for constructing storehouses, mast-houses, mast-ponds, and slip, smithery, and artificers' workshops of every description. *5thly*, A further extension of the dock-yard, by the addition of ten or twelve acres of a low marshy tract of land called Major's Marsh, which at present is below the level of the sea, and the water kept out, as in Holland, by embankments, but which will be raised several feet by the excavation of the basin, the dry docks, and the mast-ponds, so as to allow of drains to carry off the water to the shore, affording space for timber-births, houses and gardens for all the officers of the dock-yard, as well as for the admiral commanding in chief at Sheerness and the Nore. These additions, together with some part of the premises held by the board of ordnance, will make the whole area of the new dock-yard of Sheerness amount to upwards of fifty acres. The wharf wall on the south side of the basin in front of the intended mast-houses is a hundred feet, and that on the river front sixty feet in width, lined on both sides with as complete a specimen of good and beautiful masonry of granite as any in the kingdom.

The usual officers, with their clerks, amounted during the war to about fifty; and the shipwrights, artificers, and labourers, to about eight hundred; the shipwrights being the most numerous, as the principal part of the work was confined to the repairing of small vessels in the yard, but mostly to repairs of the fleet afloat at the Nore or in the Medway.

Portsmouth Dock-Yard.—Portsmouth dock-yard will always be considered as the grand naval arsenal of England, and the head-quarters or general rendezvous of the British fleet. The dock-yard accordingly is by far the most capacious; and the safe and extensive harbour, the noble anchorage at Spithead, the central situation with respect to the English Channel and the opposite coast of France, and particularly with regard to the naval arsenal at Cherbourg, render Portsmouth of the very first importance as a naval station; and in this view of it, every possible attention appears to have been paid to the extension and improvement of its dock-yard. The sea wharf-wall of this yard, extending in the direction of north and south along the western shore of the harbour, is about 3500 feet in length, and the mean depth may be 2000 feet; and it incloses an area of more than one hundred acres.

In the centre of the wharf-wall, facing the harbour, is the entrance into the great basin, whose dimensions are 380 by 260 feet, and its area $2\frac{1}{2}$ acres. Into this basin open four excellent dry docks, and on each of its sides is a dry dock opening into the harbour; and all of these six docks are capable of receiving ships of the largest class. Besides these is a double dock for frigates, the stern dock communicating through a lock with the harbour, and the head dock with another basin about 250 feet square. There is also a camber, with a wharf-wall on each side, 660 feet in length, and of sufficient width to admit of transports and merchant ships bringing stores to the dock-yard. In the same face of the yard are three building slips capable of receiving the largest ships, and a small one for sloops, besides two building slips for frigates on the northern face of the yard, and a smaller slip for sloops. The range of storehouses on the north-east side, and the rigging-house and sail-loft on the south-west side of the camber, are magnificent buildings, the former occupying nearly 600 feet in length, exclusive of the two intermediate spaces, and nearly sixty feet in width, and the two latter 400 feet. The two hemp-houses and the two sea-store houses occupy

a line of building which, with the three narrow openings between them of twenty-five feet each, extend 800 feet. The rope-house, tarring-house, and other appendages of the ropery, are on the same scale. The two sets of quadrangular storehouses, and the two corresponding buildings, with the intervening timber-births and saw-pits, at the head of the dry docks, issuing from the great basin, are all excellent, and conveniently placed. The smithery is on a large scale, and contiguous to it is an iron-mill, a copper-mill, and a copper refinery, at which is remelted and rolled all the old copper which is taken from ships' bottoms; and here, also, are cast bolts, gudgeons, and various articles of copper used in the navy. The number of sheets manufactured in one year of the war amounted to about 300,000, weighing above 12,000 tons; on which it has been calculated that a saving of at least L.20,000 was effected for the public, besides obtaining a good pure article. Most of these were constructed under the direction of General Bentham. (*Bentham's Services.*) At the head of the north dock are the wood mills, at which every article of turnery, rabitting, &c. is performed for the use of the navy, from boring the chamber of a pump to the turning of a button for a chest of drawers. But the principal part of these mills is the machinery for making blocks, contrived by that ingenious artist Mr Brunell (see BLOCK-MACHINERY), which cannot be regarded without exciting the highest respect for the talents and skill of the author.

The northern extremity of the dock-yard is chiefly occupied with seasoning-sheds, saw-pits, and timber-births, the working boat-house, and boat-storehouse. On the eastern extremity are situated the houses and gardens of the commissioner and principal officers of the yard; the chapel, the royal naval college, and the school of naval architecture. The former institution has recently been remodelled, and the latter is a new establishment formed by the recommendation of the commissioners for revising the civil affairs of the navy, for the education of a certain number of naval architects, known by the name of the "Superior Class of Shipwright Apprentices." These two establishments were combined by order in council of the 30th January 1816, under the following regulations:

Naval College.—The number of students not to exceed, in time of war, one hundred; in peace seventy; of whom thirty are to consist of the sons of commissioned officers of the navy, and to receive their board, clothing, lodging, and education, free of all expense; the remainder to consist of sons of noblemen, gentlemen, civil and military officers, on payment of L.72 a year. The age of admission from twelve and a half to fourteen years. A bond is to be signed by their friends, in the penalty of L.200 for the first class, and L.100 for the second class, in the event of any young gentleman being withdrawn from the navy before he has served the proper time to qualify for the commission of lieutenant. (See article NAVY.) No student to remain at college longer than three years; at the end of which, or sooner if he shall have completed the plan of education, he is discharged into one of his majesty's ships, the college time being reckoned two years of the six required to be served to qualify for such commission.

Naval Architectural School.—The number of students not to exceed twenty-four. Candidates for admission examined at stated periods, the degree of merit alone giving preference of admission; the age of entrance from fifteen to seventeen, and the duration of their apprenticeship seven years. The students are lodged, boarded, and educated, free of all expense, and have the following yearly allowances: 1st year L.25, 2d L.30, 3d L.35, 4th L.40, 5th L.45, 6th L.50, 7th L.60. And at the expiration of their apprenticeship they are eligible to all the situations

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in the ship-building department of his majesty's dock-yards, to be there employed as supernumeraries until regular vacancies may occur; provided the apprentice shall have completed the plan of education, and be certified by the professor to be properly qualified.

The consolidated establishment of the two departments consists of a governor, who is the first lord of the admiralty for the time being; a lieutenant-governor, who is a post-captain in the navy, with a salary of L.800 a year and apartments; two lieutenants of the navy, with L.200 a year each, apartments, and an allowance for board; a professor, who is a graduate of the university of Cambridge, with a salary of L.700 a year, and apartments; a master of classics, history, and geography, with L.350 a year and apartments; three assistant-masters, well skilled in mathematics, the first with L.250, the two others L.200 a year each, with an allowance for house-rent; besides masters for teaching drawing, dancing, fencing, and the French language, and two serjeants of marine artillery. In addition to these, there is a superintendent of the school for naval architecture, a professional ship-builder, brought up in one of his majesty's dock-yards, to instruct the apprentices in the practical parts of ship-building. The school for naval architecture has recently been abolished.

The professor has the charge and keeps the rate of all the chronometers which may not be in use belonging to the navy; and all midshipmen in the navy are now required to pass their examination in the theory of navigation, at the naval college, by the professor, in presence of the admiral commanding in chief, and the lieutenant governor. (See NAVY.)

The strength of Portsmouth dock-yard, during the war, was considerably above 4000 working men, of whom about 1500 were shipwrights and caulkers; the joiners and house-carpenters were nearly 500; the smiths 200 nearly; the sawyers 250; the riggers and their labourers nearly 200; the scavelmen and labourers of various kinds nearly 700; and the rope-yard employed about 350 persons.

There are two victualling establishments at this port; the one in Portsmouth town, the other across the harbour, at a place called Weevil; both of them inconveniently situated for supplying the ships with water and provisions, more especially such as may have to take them in at Spithead. The former consists chiefly of provision-stores and magazines, with a tide-mill and a bakery; at the latter there is a cooperage and a brewery. The total number of persons employed, including the officers, at the two establishments, during the war, amounted to about 500. The victualling establishments are now consolidated at Weevil.

The noble building for the reception of sick and wounded seamen is situated on the Gosport side of Portsmouth harbour. Being appropriated to the military branch of the navy, it will be described under the head of NAVY.

The second division of royal marines, consisting of eighteen companies, is stationed at Portsmouth, in barracks, which are inconveniently situated in the town; and eight companies of the royal marine artillery have their head-quarters at Fort Monckton, not far from Haslar Hospital. (See the article MARINES.)

Plymouth Dock-Yard.—The naval station of Plymouth is inferior only to that of Portsmouth; and, in point of its more westerly situation, as considered with reference to the grand naval arsenal of Brest, it is superior even to Portsmouth. It possesses one of the finest harbours in the world, capable of containing, in perfect security at their moorings, not less than a hundred sail of the line; and by means of the breakwater it may boast of an excellent roadstead for eighteen or twenty sail of the line. The dock-yard, however, has only one small basin, without gates, whose dimensions are 250 by 180 feet, and con-

tents little more than an acre; but the excellent harbour of Hamoaze, on the western bank of which the wharf-wall extends, almost compensates for the want of one, especially as the depth of water allows the largest ships to range along the jetties, and receive their stores on board immediately from the wharf.

Plymouth dock-yard extends in a circular sweep along the shores of Hamoaze 3500 feet, its width about the middle, where it is greatest, being 1600, and at each extremity 1000 feet, making its superficial contents about ninety-six acres. In the line facing the harbour are two dry-docks for ships of the first rate, a double dock for seventy-four gun ships, communicating with Hamoaze, and another dock for ships of the line, opening into the basin. There is, besides, a graving-dock without gates, and a canal or camber similar to that in Portsmouth yard, for the admission of vessels bringing stores into the yard; which, communicating with the boat-pond, cuts the dock-yard nearly into two parts. There are five jetties projecting from the entrances of the dry-docks into Hamoaze, along side of which ships are conveniently brought when undocked. All these are situated between the centre and the northern extremity of the harbour line. On the southern part are three building slips for the largest class of ships, and two for smaller vessels; the outer mast-pond and mast-houses, timber-births, saw-pits, and smithery. Higher up, on this end of the yard, is an extensive mast-pond and mast-locks, with plank-houses over them; and, above these, three hemp magazines, contiguous to which is the finest ropery in the kingdom, consisting of two ranges of buildings, one the laying-house, the other the spinning-house, each being 1200 feet in length, and three stories in height. In the construction of the new rope-house no wood has been used excepting the shingles of the roof, to which the slates are fastened. All the rest is of iron. The ribs and girders of the floors are of cast iron, covered over with Yorkshire paving stone, and the doors, window frames, and staircases, are all of cast iron, so that the whole building may be considered as proof against fire.

The northern half of the yard, besides the docks and basin, with all the appropriate working sheds and artificers' shops, contains a cluster of very elegant stone buildings, ranged round a quadrangle, the longest sides being about 450 feet, and the shortest 300 feet. Within the quadrangle are also two new ranges of buildings, in which iron has been used in the place of wood. These buildings consist of magazines for different kinds of stores, rigging-houses, and sail-lofts. The northern and upper part of the yard is occupied by a range of handsome houses, with good gardens behind them, for the commissioner and the principal officers of the yard, the chapel, the guard-house, and pay-office, stables for the officers, and the teams, and a fine reservoir of fresh water for the supply of the yard.

Plymouth is not only a good building and repairing yard, on account of its excellent docks and slips, and the great length of line along the Hamoaze, but also a good refitting yard, and was fully occupied during the war with the refitment of the western squadron, employed in the constant blockade of Brest. The number of men borne on the establishment of this yard might have been about 3000, of which about 800 were shipwrights.

Plymouth Victualling Establishments.—The victualling establishments are here, as well as at Portsmouth, unconnected, and, in fact, dispersed in three different places; the cooperage and the brewery being at South Down, near Millbrook, on the farther side of Hamoaze; the bake-house and principal stores at the entrance of Sutton Pool, in the Catwater; and the slaughter-house on the Devil's Point, at the head of the Sound. The total establishment of the victualling department at this port, officers includ-

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ed, amounted to about 400 persons. As at Portsmouth, the victualling establishments have been consolidated at Cremill, which consists of every possible convenience for victualling and watering the navy.

Plymouth Hospital is a handsome building of stone, or rather a series of separate buildings, regularly arranged, in which respect, as admitting a freer circulation of air, it is perhaps superior to that of Haslar. (See NAVY.)

The third division of royal marines, consisting of twenty companies, are stationed at Plymouth. The barracks are conveniently situated at Stonehouse, very airy, and sufficiently spacious. (See MARINES.)

Pembroke Dock-Yard.—This dock-yard has been established but a few years, and is intended merely as a building-yard. It is situated on the southern shore of Milford Haven, not two miles from the town of Pembroke. It includes an area of about sixty acres, its surface descending in a gradual slope to the water's edge, along the shore of which is ample space for a couple of dry docks, and at least twelve building slips, over which it is intended to erect a connected series of roofs, which will not only be attended with much convenience to the workmen, but also with a great saving of expense. The slips, being built of wood, on a limestone foundation, are erected at a very trifling cost; and the only works of any considerable expense in the yard will be those of the dry docks, each of which will amount to the sum of L.60,000 nearly. For a new building yard a small storehouse will be quite sufficient, and an old ship hauled up serves all the purposes of one at present. There is no commissioner, nor is the usual establishment of officers completed. The total number of persons of all descriptions employed in the yard is under 500.

Ordinary of the Dock-Yards.—At each of the ports where there is a dock-yard, Pembroke excepted, a certain number of ships when put out of commission, or new ships not commissioned, are laid up in what is called a state of ordinary; and such ships, until recently, used to be placed under the immediate charge of the commissioner, the masters attendant, and other officers of the dock-yard. But a new system has lately been adopted, both with regard to the fitting of the ships for their better preservation, while thus unemployed (See DRY ROT), and also as to the care and management of them by naval commissioned officers living constantly on board. (See NAVY.)

Capacity of a Dock-Yard.—The capacity of a dock-yard for building, repairing, and refitting ships of war, depends upon so many circumstances that it scarcely admits of calculation; chiefly, however, on the facilities afforded by a suitable arrangement of dry docks, building slips, and basins, and on the number of shipwrights and other artificers borne on the strength of the yard. In building new ships, where the materials are at hand, and no interruptions occur, the capacity may be ascertained to a tolerable degree of accuracy. To complete the building of a seventy-four gun ship, it is calculated that the labour of one man would be required for 18,000 days, or of eighteen men for 1000 days, or about fifty-four men to finish her in the space of one year. A dock-yard, therefore, with 500 good shipwrights, might be expected to launch from eight to ten sail of the line every year, if the conveniences of the yard admitted them all to be employed on building. But with regard to repairs, they are so various and so uncertain, that it would be next to impossible to form any calculation that should at all approach to the truth. A writer well versed in naval matters, in attempting to prove the sufficiency of our dock-yards, without having recourse to private merchant yards during war, has stated, that by a uniform system of management, "the annual regene-

ration of ships of the line may be safely reckoned at *twelve sail*, and that of frigates at *eight sail*;" and that, besides, there "might be docked for casual repairs, in the course of one year, *two hundred and sixty-seven sail* of ships and vessels of war." (*Letter to Lord Melville on the General State of the Navy*, 1810.)

When Henry VIII. first established a regular king's dock-yard at Woolwich, he appointed a board, consisting of certain commissioners, for the management of all naval matters; and it is curious enough, as appears from the *Pepysian Collection of Manuscripts* in the university of Cambridge, that the regulations which he made for the civil government of the navy, and which were, in the reign of Edward VI., revised, arranged, and turned into ordinances, form the broad basis of all the subsequent instructions given to the several officers to whom the management of the civil affairs of the navy has been committed. (*First Rep. Nav. Rev.*)

The commissioners of the navy then consisted of the vice-admiral of England, the master of the ordnance, the surveyor of the marine causes, the treasurer, comptroller, general surveyor of the victualling, clerk of the ships, and clerk of the stores. They had each their particular duties; and once a week they were ordered to meet at their office on Tower Hill, and once a month to report their proceedings to the lord high admiral.

In 1609 the principal officers for conducting the civil affairs of the navy were suspended in consequence of many abuses being complained of; and other commissioners were appointed, with powers to manage, settle, and put the affairs of the navy into a proper train, and to prevent, by such measures as might appear to be necessary, the continuance of the many great frauds and abuses which had prevailed. A similar commission was renewed in 1618, which in a full and minute report detailed and explained those frauds and abuses.

That commission, which ended on the death of James I., was renewed by his successor, and remained in force till 1628, when it was dissolved, and the management of the navy was restored to the board of principal officers, as established by Edward VI.

In the disturbed reign of Charles I. the navy was suffered to go to decay; but by the extraordinary exertions of Cromwell, it was raised to a height which it had never before reached, but again declined under the short and feeble administration of his son.

On the restoration of Charles II. the Duke of York was appointed lord high admiral; and by his advice a committee was appointed to consider a plan he had drawn out for the future regulation of the affairs of the navy, at which he himself presided. "In all naval affairs," say the commissioners of revision, "he appears to have acted with the advice and assistance of Mr Samuel Pepys, who first held the office of clerk of the acts, and was afterwards secretary of the admiralty; a man of extraordinary knowledge in all that related to the business of that department, of great talents, and the most indefatigable industry."

The entire management of the navy was now in the hands of the duke, as lord high admiral, by whom three new commissioners were appointed to act conjunctly with the treasurer of the navy, the comptroller, the surveyor, and clerk of the acts, as principal officers and commissioners of the navy. A book of instructions, drawn out by Mr Pepys, was sent to the navy board for its guidance. A rapid progress was made in the repair and augmentation of the fleet; but being called away, in consequence of the Dutch war in 1664, the example of zeal and industry set by Mr Pepys was not sufficient, in the duke's absence, to prevent

Dock-
Yards.

Manage-
ment of the
dock-yards,
&c.

Commis-
sioners of
the navy.

Duke of
York the
lord high
admiral.

Dock-Yards. neglect and mismanagement in every department except his own.

New set of commissioners. From 1673 to 1679, the office of lord high admiral being put in commission, at the head of which Prince Rupert was placed, the king, through Mr Pepys, arranged all naval affairs; but in the latter year, when the duke was sent abroad, and Mr Pepys to the Tower, a new set of men were made commissioners of the navy, who, without experience, ability, or industry, suffered the navy to go to decay. "All the wise regulations," say the commissioners of revision, "formed during the administration of the Duke of York, were neglected; and such supineness and waste appear to have prevailed as, at the end of not more than five years, when he was recalled to the office of lord high admiral, only twenty-two ships, none larger than a fourth rate, with two fire-ships, were at sea; those in the harbour were quite unfit for service; even the thirty new ships which he had left building had been suffered to fall into a state of great decay, and hardly any stores were found to remain in the dock-yards." He re-appointed Mr Pepys as secretary of the admiralty; he set about an inquiry into the characters and abilities of the first ship-builders in England; and by the advice of Mr Pepys, he joined Sir Anthony Dean, eminent in that profession, with three others, to the former principal officers in a new commission. The old commissioners were directed entirely to confine their attention to the business of a committee of accounts. To each of the new ones was entrusted a distinct branch of the proposed reform; and it appears that, highly to their credit, "they performed what they had undertaken in less time than was allowed for it, and at less expense;" having completed their business to the general satisfaction of the public two months before the Revolution.

The business of the navy, thus methodized and settled, remained undisturbed by that event. The commissioners of revision justly observed, that "the great work of re-establishing the fleet, and restoring order, industry, and discipline, in the dock-yards, accomplished in so short a time by the commissioners then chosen, with so much care, proves, in the most convincing manner, how much depends on having the civil affairs of the navy placed under the management of men of real ability, professional knowledge, and uninterrupted industry."

Commissioners of naval inquiry and revision. It will readily be supposed that the vast increase of our naval force since that time has necessarily required many additional orders and regulations, some of which, from circumstances, were not compatible with each other; some were given to one dock-yard and not to another; others in one yard became obsolete, while they continued to be acted upon in another; so that there was no longer that uniformity in the management which it is so desirable, indeed so essentially necessary, to preserve. From the year 1764 to 1804, when his majesty appointed a commission "for revising and digesting the civil affairs of his navy," the attention of the lords of the admiralty and the navy board had frequently been directed to this important subject; but owing to various causes nothing was done to forward so desirable an arrangement, except that Sir Charles Middleton (afterwards Lord Barham), when comptroller of the navy, classed and digested under distinct heads, in a book for that purpose, all orders and regulations prior to the year 1786. The commissioners of naval inquiry, appointed in 1803, state the necessity of revising the instructions, and digesting the immense mass of orders issued to the dock-yard officers, and regret that a work of such utility should not have been completed. The late Lord Melville, to whom the navy is perhaps more indebted than to any single individual, and who, from the active part he had long taken in its concerns, was well aware of the irregularities

and disorder which prevailed in the dock-yards, on his appointment to the administration of naval affairs, determined to carry into execution a complete system of reform and of uniform management in all the several departments. The commission consisted of Admiral Lord Barham, John Fordyce, Esq. Admiral Sir Roger Curtis, Bart. Vice Admiral Domett, and Ambrose Serle, Esq. They made fifteen distinct reports, the date of the first being 13th June 1805, of the last the 6th March 1808; all of which, except two, have been printed, by order of the House of Commons, and mostly carried into effect by his majesty's orders in council. One of the two not printed is an inquiry into the state of the navy at different periods, and of naval timber; the other relates to the formation of a new dock-yard at Northfleet, which, however advisable and even necessary the design of it might have been considered at the time when Bonaparte was energetically carrying on his mighty plans for the creation of a naval force to contest the power of the ocean with Great Britain, will, as has already been observed, no longer be thought so under present circumstances.

From these reports have been established, for the first time, in all his majesty's dock-yards, one uniform system of management, by which it was hoped incalculable advantages would have been derived to the public, in the preventing of frauds, in the saving of labour and materials, and consequently time and expense, and in securing better workmanship in the construction of ships, which is perhaps of all other considerations the most important; but the system was cumbrous and very expensive.

The management of the dock-yards, and of all the civil affairs of the navy, was, until recently, entrusted to certain commissioners appointed by patent, of whom the comptroller of the navy and three surveyors, and seven other commissioners, formed a board at Somerset House, for the general direction and superintendence of the civil concerns of the navy, subject to the control of the lords commissioners of the admiralty. At most of the home yards and of the foreign yards was a commissioner of the navy, who was always a naval officer of the rank of captain. The foreign yards over which a commissioner presided were, Bermuda, Cape of Good Hope, Gibraltar, Halifax, Jamaica, Malta, Quebec, Kingston, including the lake establishments and Trincomalee, which, with the five belonging to the home yards, Woolwich (including Deptford), Chatham, Sheerness, Portsmouth, and Plymouth, made the whole number of commissioners of the navy amount to twenty-four. The salary of each of the home commissioners was L.1000 a year, that of the comptroller L.2000. The salary of the foreign commissioners L.1200 a year, except that of the Cape of Good Hope, which was L.1800, and Trincomalee L.3000 a year. They were also entitled to liberal superannuations when unfit for further service; and, at their death, their widows received a pension for life of L.300 a year. All these have been swept away, and the two great departments, the navy and the victualling offices, have been consolidated with the admiralty, and the details of the business placed under five principal officers, each having a separate department. These are, 1. the surveyor of the navy; 2. the accountant general; 3. the storekeeper general; 4. the comptroller of the victualling and transports; 5. the physician.

The treasurer of the navy is a high and responsible officer appointed by the crown, and removeable at pleasure. His salary was L.4000 a year, but it has recently been reduced to L.3000. The establishment of the navy pay-office at Somerset House consists of a paymaster and deputy; three cashiers, one for the navy, one for the victualling, and one for the allotment branch; an accountant;

Dock-Yards.

Uniform system of management introduced.

Commissioners of the navy.

Of the treasurer's office.

Doctor. inspector; a superintendent of the payments of the dock-yards, resident in London; sixty established and eighteen extra clerks, besides six pay clerks and three conductors of money at the four pay ports, Portsmouth, Plymouth, Chatham, and Sheerness.

Victual-ling establishment. To each of the four dock-yards, Deptford, Portsmouth, Plymouth, and Chatham, are victualling establishments for supplying the fleet with provisions and water; and also at Dover, Cork, Cape of Good Hope, Gibraltar, and Malta. The victualling board at Somerset House consisted of a chairman and deputy chairman, the former with a salary of L.1200, the latter of L.1000 a year, and five other commissioners with salaries of L.800 a year each; a secretary to the board, and a secretary to the committee of accounts; a registrar of securities, and 136 clerks, with salaries varying from L.800 to L.80 a year, according to their class and length of service. These have all been abolished, and, as before stated, consolidated with the admiralty.

The transport board having been dissolved at the end of the war, its twofold duties were divided between the navy and victualling boards; those which concerned the hiring of transports devolved on the commissioners of the navy, and those which related to the sick and hurt department on the commissioners of the victualling board, on whom also devolves the direction and superintendence of all the naval hospitals at home and abroad. These have also merged in the admiralty.

Officers of the dock-yard; their duties. The principal officers of an established dock-yard were, 1. the commissioner; 2. the master attendant; 3. the master shipwright; 4. the clerk of the check; 5. the storekeeper; 6. the clerk of the survey; to which have recently been added the subordinate officers of timber-master and the master measurer. By the new regulations, the commissioner has been superseded by a superintendent, the clerk of the check and clerk of the survey abolished, as well as the master measurer, and a store receiver substituted for the timber-master. Many subordinate officers have also been abolished, and the whole system of working the men, keeping the accounts, &c. simplified and amended; and some idea may be collected of the diminution of the expense by the simple fact, that, in the ordi-

nary estimate of the navy for 1817 the establishment of officers in Portsmouth yard was L.50,065, whereas in 1833 it is only L.19,803.

Hitherto the men were usually employed by what was called task and job; but they are now wholly put upon day pay.

The commissioners of naval inquiry (*Sixth Report*) clearly expose the "combination of self-interest which has been permitted to exist against the public in all the persons who were concerned in the accounts of job-work, and the fictitious manner of making up those accounts." The quarter-men, for instance, were paid wages according to the amount of the earnings of the men under their own superintendence, and the accounts of those earnings were taken by themselves. General Bentham has furnished an instance of the gross abuses which existed under the old system of job-work. "By the regulations of the navy board, nothing less than L.5. 2s. was to be paid for the *smallest* repair of a thirty-four feet launch. If the above sum should be found inadequate to the payments for the work done to a boat of this class, the repair was then to be denominated a *middling* repair; in which case L.11. 1s. was the exact sum. Again, if this sum were insufficient, the repair was to be denominated a *large* repair; and in this case, although the value of the workmanship might have exceeded the sum of L.11. 1s. only by a few shillings, the expense was to have appeared in the account as doubled, and set down at L.22. 2s. and nothing less was to be the exact sum paid for this work." Nothing was more common, in estimating a man's wages, than to find him working three or four tides, and very often three nights, in one day. (Bentham's *Services*, &c.) The whole of this system is now done away; and the consequence is, that as much work is performed, and turned out in a more workman-like manner, and a very large saving, both in pay and materials, by resorting to day pay, under proper superintendence. The effect of the change of system, and the reductions that have been made in the establishments at home and abroad, have reduced the expense in the year 1817 from about L.556,000 to L.286,000, making a saving of L.270,000 a year.

DOCTOR, a person who has passed all the degrees of a faculty, and is empowered to teach or practise the same. Thus we say, doctor in divinity, doctor in physic, doctor of laws.

The establishment of the *doctorate*, as now in use amongst us, is ordinarily attributed to Irnerius, who himself drew up the formulary. The first ceremony of this kind was performed at Bologna, in the person of Bulgarus, who began to profess the Roman law, and on that occasion was solemnly promoted to the *doctorate*, that is, installed *juris utriusque doctor*. But the custom was soon transferred from the faculty of law to that of theology; the first instance of which was given in the university of Paris, where Peter Lombard and Gilbert de la Portrée, the two leading divines of those days, were created doctors in theology, *sacrae theologiae doctores*.

Spelman conceives the title of doctor not to have commenced till after the publication of Lombard's sentences, about the year 1140. Others, however, go much higher, holding Bede to have been the first doctor at Cambridge, and John de Beverley at Oxford, where the latter died in the year 721. But Spelman contends that doctor was not the name of any title or degree in England till the reign of King John, that is, about the year 1207. As to the qualifications or course of study necessary to obtain the

degree of doctor in the different faculties of theology, law, and medicine, see the article UNIVERSITIES.

Doctor of the Law, a title of honour among the Jews. The investiture, if we may so speak, of this order, was performed by putting a key and a table book in their hands; and this is what some authors imagine our Saviour had in view (Luke, xi. 52) when, speaking of the doctors of the law, he says, "Wo unto you, lawyers! for ye have taken away the key of knowledge; ye enter not in yourselves, and them that were entering in ye hindered."

Doctor of the Church, a title given to certain of the fathers whose doctrines and opinions have been the most generally followed and authorized. We usually reckon four doctors of the Greek church and three of the Latin. The former are, St Athanasius, St Basil, St Gregory Nazianzen, and St Chrysostom; the latter are St Jerome, St Augustin, and Gregory the Great. In the Roman breviary there is a particular office for the doctors, which only differs from that of the confessors by the anthem of the Magnificat and the lessons.

Doctor is also an appellation adjoined to a specific epithet, expressing the merit of some eminent schoolman. Thus, Alexander Hales is called the irrefragable doctor; Thomas Aquinas, the angelic doctor; St Bonaventure, the seraphic doctor; John Duns Scotus, the subtile doc-

Doctor **Doddridge.** tor; Raimond Lully, the illuminated doctor; Roger Bacon, the admirable doctor; and so of the rest.
DOCTOR (Διδασκαλος), in the Greek church, is a particular officer, appointed to interpret portions of the Scriptures. He who interprets the gospels is called *doctor of the Gospel*; he who interprets St Paul's Epistles, *doctor of the Apostles*; he who interprets the Psalms, *doctor of the Psalter*.

DOCUMENT, in *Law*, some written monument produced in proof or support of any thing asserted.

DODD, DR WILLIAM, an unfortunate English divine, eldest son of the Rev. William Dodd, many years vicar of Bourne, in Lincolnshire, was born in May 1729. He was sent, at the age of sixteen, to the university of Cambridge, where he was admitted a sizar of Clare-Hall in the year 1745. In 1750 he took the degree of B. A. with credit, being upon that occasion in the list of wranglers. On leaving the university, he imprudently married a Miss Mary Perkins in 1751, was ordained a deacon the same year, and priest in 1753, and soon became a popular and celebrated preacher. His first preferment was the lectureship of West-Ham and Bow. In 1754 he was also chosen lecturer of St Olave's, Hart Street; and in 1757 he took the degree of A. M. at Cambridge. He was a strenuous supporter of the Magdalen Hospital, which was founded in 1758, and soon afterwards became preacher at the chapel of that charity. By the patronage of Bishop Squire, he in 1763 obtained a prebend at Brecon; and by the interest of some city friends got himself appointed one of the king's chaplains; soon after which the education of the Earl of Chesterfield was committed to his care. In 1766 he went to Cambridge and took the degree of LL.D. At this period, the estimation in which he was held by the world was sufficient to give him the expectation of preferment, and hopes of riches and honour; and these he might probably have realised had he possessed a portion of common prudence and discretion. But, impatient of his situation, and eager for advancement, he unhappily fell upon means which in the end proved the occasion of his ruin. On the living of St George, Hanover Square, becoming vacant, he wrote an anonymous letter to the chancellor's lady, offering three thousand guineas if, by her assistance, he was promoted to the benefice. This letter having been traced to him, a complaint was immediately made to the king, and Dr Dodd was dismissed with disgrace from his office of chaplain. From this period he lived neglected, if not despised; and as his extravagance still continued, he soon became involved in difficulties, which tempted him to forge a bond on his late pupil Lord Chesterfield, for L.4200, which he actually received. But he was detected, committed to prison, tried at the Old Bailey, found guilty, received sentence of death, and, in spite of numerous applications for mercy, executed at Tyburn on the 27th of June 1777. Dr Dodd was a voluminous writer, and possessed considerable abilities, with but little judgment and much vanity. An accurate list of his various writings is prefixed to his *Thoughts in Prison*, 1781.

DODDRIDGE, PHILIP, D.D. an eminent Presbyterian minister, was the son of Daniel Doddridge, an oilman in London, where he was born on the 26th of June 1702. Having completed the study of the classics in several schools, he was in 1719 placed under the tuition of the Reverend John Jennings, who kept an academy at Kilworth, in Leicestershire. He was first settled as a minister at Kilworth, where he preached to a small congregation in an obscure village; but, on the death of Mr Jennings, he succeeded to the charge of his academy; and soon afterwards he was chosen minister of a large congregation of Dissenters at Northampton, to which he removed his aca-

demy, and where the number of his pupils increased. He instructed his pupils with the freedom and tenderness of a father; and never expected nor desired that they should blindly follow his sentiments, but encouraged them to judge for themselves. He checked any appearance of bigotry and uncharitableness, and endeavoured to cure them by showing what might be said in defence of those principles which they disliked. He died at Lisbon, whether he had gone for the recovery of his health; and his remains were interred in the burying-ground belonging to the British factory there. A handsome monument was erected to his memory in the meeting-house at Northampton, at the expense of the congregation, on which there is an epitaph written by Gilbert West, Esq. He wrote, 1. *Free Thoughts on the most probable means of reviving the Dissenting Interest*; 2. *The Life of Colonel James Gardiner*; 3. *Sermons on the Education of Children*; 4. *The Rise and Progress of Religion in the Soul*; 5. *The Family Expositor*, in 6 vols. 4to; and other works. Since the author's death, a volume of his hymns has been published, and his Theological Lectures. Several of his works have been translated into Dutch, German, and French.

DODECAGON, in *Geometry*, a regular polygon, consisting of twelve equal sides and angles.

DODECAHEDRON, in *Geometry*, one of the platonic bodies, or regular solids, contained under twelve equal and regular pentagons.

DODONA, a town of Thesprotia, in Epirus, or, according to others, in Thessaly, in the neighbourhood of which there was a celebrated oracle of Jupiter. The town and temple of the god were first built by Deucalion, after the universal deluge. It was supposed to be the most ancient oracle of all Greece; and, according to the traditions of the Egyptians mentioned by Herodotus, it was founded by a dove. Two black doves, as he relates, took their flight from the city of Thebes in Egypt; one of which flew to the temple of Jupiter Ammon, and the other to Dodona, where, with a human voice, it acquainted the inhabitants of the country that Jupiter had consecrated the ground, and in future would give oracles. The extensive grove which surrounded Jupiter's temple was endowed with the gift of prophecy; and oracles were frequently delivered by the sacred oaks, and the doves which inhabited the place. This fabulous tradition of the oracular power of the doves is explained by Herodotus, who observes that some Phœnicians carried away two priestesses from Egypt, one of which went to fix her residence at Dodona, where the oracle was established. It may further be observed, that the fable might have been founded upon the double meaning of the word *τελειαι*, which signifies *doves* in most parts of Greece, whilst in the dialect of the Epirots it means *old women*. In ancient times the oracles were delivered by the murmuring of a neighbouring stream or fountain; but the custom was afterwards changed. Large kettles were suspended in the air near a brazen statue which held a lash in its hand. When the wind blew strong, the statue was agitated and struck against one of the kettles, which communicated the motion to all the rest, and raised that clattering and discordant din, which continued for a while, and from which the artifice of the priests derived the predictions. Some suppose that the noise was occasioned by the shaking of the leaves and boughs of an old oak, which the superstition of the people frequently consulted, and from which they pretended to receive oracles. It may be supposed, with more probability, that the oracles were delivered by the priests, who by artfully concealing themselves behind the oaks, caused the superstitious multitude to believe that the trees were endowed with the power of prophecy. As

Dodona.

Dodonian the ship Argo was built with oaks of the forest of Dodona, there were some beams which gave oracles to the Argonauts, and warned them against the approach of calamity. Within the forest of Dodona there was a stream and a fountain of cool water which had the power of lighting a torch as soon as the latter touched it. This fountain was totally dry at noon day, and was restored to its full course at midnight, from which time till the following noon it began to decrease, and at the usual hour was again deprived of its waters. The oracles of Dodona were generally delivered by women.

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Dofar.

DODONIAN (*Dodonæus*), in *Antiquity*, an epithet given to Jupiter, because he was worshipped in a temple built in the forest of Dodona, where there was the most famous, and, it is said, the most ancient, oracle of all Greece. See **DODONA**.

DODONIDES, the priestesses who gave oracles in the temple of Jupiter in Dodona. According to some traditions, the temple was originally inhabited by seven daughters of Atlas, who nursed Bacchus, and whose names were Ambrosia, Eudora, Pasithoe, Pytho, Plexaure, Coronis, and Tythe or Tyche. In the latter ages the oracles were always delivered by three old women. The Bœotians were the only people of Greece who received their oracles at Dodona from men, for reasons which Strabo in his ninth book fully explains.

DODRANS, in *Antiquity*, three fourths of the *as*. See the article **As**.

DODSLEY, ROBERT, an eminent bookseller and ingenious writer, born at Mansfield, in Nottinghamshire, in the year 1703. He was not much indebted to education for his literary reputation, being originally a livery servant; but his natural genius and early passion for reading soon elevated him to a superior station. He wrote an elegant little satirical farce called *The Toyshop*, which was acted with applause in 1735, and which recommended him to the patronage of Mr Pope. The following year he produced the *King and Miller of Mansfield*. The profits of these two farces enabled him to commence bookseller, and his own merit procured him eminence in that profession. He wrote some other dramatic pieces, and published a collection of his works in one volume 8vo, under the modest title of *Trifles*, which was followed by *Public Virtue*, a poem in 4to. Mr Dodsley was the author of the *Economy of Human Life*, a work which acquired considerable celebrity; but for this it is supposed to have been indebted to the mistaken opinion which long prevailed of its being the production of Lord Chesterfield. The name of Dodsley is connected or associated with much of the literature of his time. Among other things he projected the *Annual Register*, in concert with Edmund Burke, who is known to have mainly contributed to its success. It would be tedious and uninteresting to enumerate the various literary enterprises in which he engaged. His personal character was excellent; he observed the strictest integrity in all his dealings; and he lived on easy terms with authors of high rank as well as genius. Dodsley may be considered as one of the founders of a great London book-selling establishment.

DODWELL, HENRY, a very learned controversial writer, of English extraction, born at Dublin in 1641. He wrote an incredible number of tracts, but his services were so little acknowledged, that Bishop Burnet and others accuse him of doing more harm than good to the cause of Christianity, by his indiscreet love of paradoxes and novelties, and thus exposing himself to the scoffs of unbelievers. His pamphlet on the immortality of the soul gave rise to the well-known controversy between Mr Collins and Dr Clarke on that subject. He died in 1711.

DOFAR, or **DAFAR**, a seaport of Arabia, in the pro-

vince of Hadramaut, on the west coast of a bay of the same name in the Arabian Sea. The chief export of this town consists of olibanum. It is governed by a scheik, who is a sovereign prince. The inhabitants behave with civility to Europeans. It is 120 miles north from Cape Fartach.

DOFARY, a town of Arabia, which is now of small size, but was formerly of greater importance, and was destroyed by the Portuguese in 1526. Long. 54. 33. E. Lat. 17. N.

DOG. For an account of the natural history, acquired habits, and general uses, of the various races of this sagacious animal, see *Canis*, in the index to the article **MAMMALIA** of this work.

DOG-Days. See **CANICULA**.

DOG-ISLAND, or **DESVENTURADA**, an island in the South Pacific Ocean, about twelve miles in circumference. This island is low and wooded. It was discovered by Le Maire and Schouten. Long. 141. 30. W. Lat. 15. 15. S.

DOGE, the title of the chief magistrate in the republics of Venice and Genoa. The word properly signifies *duke*, being formed from the Latin *dux*; as *dogate* and *dogado* are formed from *ducatus*, a duchy.

The dogate, or office and dignity of doge, was elective; at Venice the doge being elected for life, and at Genoa only for two years. He was addressed under the title of *Serenity*, which among the Venetians was accounted superior to that of highness.

The doge was the chief of the council, and the mouth of the republic; yet the Venetians did not go into mourning at his death, because he was not their sovereign, but only their first minister. In effect, the doge of Venice was merely the phantom or shadow of the majesty of a prince, all the authority being reserved to the republic. He only lent his name to the senate; and the power was diffused throughout the whole body, though the answers were all made in his name. If he gave any answers on his own account, they required to be very cautiously expressed, and in general terms, otherwise he was certain to meet with a reprimand.

Anciently the doges were sovereigns; but afterwards things were much altered; and latterly the prerogatives reserved to the quality of doge were, to give audience to ambassadors, but not to make any answer as from himself in matters of importance; to answer according to his own pleasure to the compliments made to the signory, such answers being of no consequence; and, as first magistrate, to preside at all the councils. The credentials with which the senate furnished its ministers in foreign courts were written in his name, but not signed by him; this was usually done by a secretary of state, who also sealed them with the arms of the republic. The ambassadors directed their dispatches to the doge, and yet he durst not open them except in presence of the counsellors. The money was struck in the doge's name, but not with his stamp or arms. All the magistrates rose and saluted the doge when he came into council; but the doge rose to none except foreign ambassadors. In short, he was a mere pageant of state, and, politically speaking, a nonentity.

The doge nominated to all the benefices in the church of St Mark; he was protector of the Monastery delle Vergine; and bestowed certain petty offices of ushers of the household, called commanders of the palace. His family was not under the jurisdiction of the master of the ceremonies; and his children might have staff officers, and gondoliers in livery.

At the same time his state was tempered with a variety of circumstances, which rendered it exceedingly burdensome. He might not go out of Venice without leave of the council; and if he did, he was liable to receive affronts, without being entitled to demand satisfaction; and should

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any disorder happen where he was, it belonged not to him, but to the podestà, as being invested with the public authority, to put it down.

The children and brothers of the doge were excluded from all the chief offices of state. They could not receive any benefice from the court of Rome, but were allowed to accept of the cardinalate, as being no benefice, nor including any jurisdiction. The doge could not divest himself of his dignity for his ease; and after his death his conduct was examined by three inquisitors and five correctors, who sifted it with great severity. The office of doge ceased even to have a nominal existence when Venice, "sunk in its glory, decayed in its worth," yielded, almost without a struggle, to the ascendancy of republican France.

DOGGER, a Dutch fishing vessel navigated in the German Ocean. It is generally employed in the herring fishery, being equipped with two masts, namely, a main-mast and mizen-mast, and somewhat resembling a ketch.

DOGGERS, in the English alum works, a name given by the workmen to a sort of stone found in the same mines with the true alum rock, and containing some alum, though not nearly so much as the right kind. The county of York, which abounds greatly with the true alum rock, affords also a considerable quantity of these doggers; and in some places they approach so much to the nature of the true rock, that they are wrought to advantage.

DOGMA, a principal maxim, tenet, or settled opinion, particularly with regard to matters of faith and philosophy.

DOGMATICAL, something belonging to a doctrine or opinion. A dogmatical philosopher is one who asserts things positively, in opposition to a sceptic, who doubts of every thing.

DOGMATISTS, a sect of ancient physicians, of which Hippocrates was the first author. They are also called *logici*, or logicians, from their using the rules of logic in subjects of their profession. They laid down definitions and divisions; reduced diseases to certain genera, and these genera to species, furnishing remedies for them all; supposed principles, drew conclusions, and applied these to the particular diseases under consideration. In this sense the dogmatists were contradistinguished from empirics and methodists. They rejected all medicinal virtues which they thought not reducible to manifest qualities; but Galen long ago observed of them, that they must either deny plain matter of fact, or assign but poor causes and reasons for many effects which they pretended to explain.

DOGMELL, St, a town in the county of Pembroke, in South Wales, 238 miles from London, on a promontory on the northern shore of the county. The inhabitants amounted in 1801 to 1379, in 1811 to 1620, in 1821 to 2107, and in 1831 to 2109.

DOHO, a small town of Hindustan, in the province of Agra, tributary to the Mahrattas, and twenty-one miles south-west from Gwalior. Long. 79. 50. E. Lat. 26. 9. N.

DOIG, DAVID, the most learned of Scottish schoolmasters in modern times, was born in the year 1719. His father, who was a small farmer in the county of Forfar, died when he was yet in his infancy; and his mother contracted a second marriage with a worthy man, who, though by no means in affluent circumstances, and soon burdened with children of his own, treated him with the tenderness of a parent. A constitutional defect in his sight prevented him from learning to read till he was twelve years of age, but his subsequent progress was uncommonly rapid. Having for the space of three years attended a parochial school, where he was instructed in writing, arithmetic,

and Latin, he became a successful competitor for a *bursary*, or exhibition, in the university of St Andrews. Here he completed the usual course with great approbation; and, having taken the degree of A. B. he enrolled himself as a student of divinity, but his scruples respecting some articles in the Confession of Faith prevented him from entering the church. What those articles were, we have not discovered; but it appears sufficiently evident that his scruples had no reference to the essential doctrines of Christianity. Reconciling himself to the more humble avocations of a parochial schoolmaster, he for a considerable number of years taught the schools of Monifieth in his native county, and of Kennoway and Falkland in the county of Fife. He was afterwards appointed master of the grammar school of Stirling; and this office, as a late writer remarks, he discharged for forty years with the greatest ability, and with the respect and esteem of all who knew him.

His accomplishments, not only as a classical scholar, but as a man of general erudition, procured him no mean reputation long before he was known as an author. Of his extensive knowledge of languages, the earliest specimen which he imparted to the public is to be found in about twenty pages of annotations on the *Gaberlunzie-man*, inserted in an edition published by his learned friend and neighbour Mr Callander.¹ His contribution is introduced in the following terms: "For the following elucidations of the general principles laid down in the preface, and exemplified in the notes on the foregoing ballad, the public and I are indebted to a learned and worthy friend of the author, whose extensive erudition is only equalled by the modesty and candour conspicuous in his whole deportment. I am sure our learned readers will regret with me, that he has not pushed his researches further than he has done. But from the little he has here given us, the general principles of etymology I have endeavoured to establish will derive new force, and our readers new entertainment." Although his learning did not procure him any academical preferment, it at least procured him a due share of academical honours. On the same day he received a diploma of A. M. from St Andrews, and another of LL. D. from Glasgow.

After an interval of ten years, he published "Two Letters on the Savage State, addressed to the late Lord Kaims." Lond. 1792, 8vo. This work, which consists of 157 crown pages, is dedicated to Dr Horne, bishop of Norwich, and is introduced by a preface written by the author's friend Dr Gleig, a learned episcopalian clergyman of Stirling. The first letter, written in 1775, was sent to Lord Kames, who was passing his Christmas vacation at Blair-Drummond, and who was much struck with the learning and ability of his anonymous correspondent. Having without much difficulty detected the author, he invited him to dine with him next day; when they met and parted with mutual satisfaction, but with no abatement of the confidence of either party in the correctness of his own views as to the primitive condition of the human race. After a very copious and free discussion of the savage state, each of the disputants retained his own opinion; but they nevertheless laid the foundation of a cordial friendship, which continued uninterrupted during the lifetime of the judge, who survived till the year 1782. It was scarcely to be anticipated that his lordship should abandon the favourite paradox which pervades his *Sketches of the History of Man*; namely, that the tribes of mankind were originally placed in the condition of savages, from

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¹ Two ancient Scottish Poems, the *Gaberlunzie-man*, and *Christ's Kirk on the Green*: with notes and observations, by John Callander, Esq. of Craigforth. Edinb. 1782, 8vo.

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which they were enabled to emerge by the slow and gradual operation of certain instinctive principles implanted in their nature. This was a paradox which he did not himself devise, but which had already been exhibited in a variety of shapes by Condillac, Rousseau, Hume, Smith, Monboddo, and divers other speculators. Some of these lovers of wisdom delight in representing the human species as very closely allied to what we venture to describe as the lower animals; and whether the remote ancestors of men were not downright monkees, or at least ourang-outangs, they feel a very philosophical degree of hesitation in deciding. Rousseau is much inclined to doubt whether certain animals resembling the human species, but by travellers supposed to be beasts, either on account of some difference in their external formation, or merely on account of their wanting the faculty of speech, are not in reality savage men, whose race being anciently dispersed in the forests, had never had occasion to develop any of the virtual faculties, had never attained to any degree of perfection, and therefore still continued in the primitive state of nature. A shaggy skin and a long tail he did not consider as infallible marks of distinction between one race of beings and another. If such individuals as Montesquieu, Buffon, Diderot, Duclos, d'Alembert, or Condillac, had appeared in the capacity of travellers into unknown regions, he would have been disposed to listen to them when they affirmed that one animal was a man, and another a beast; but he considers it as a piece of great simplicity to leave such a matter to the decision of stupid travellers, in relation to whom one might sometimes be tempted to raise a question similar to that which they take upon themselves to determine in the case of other animals.¹ The philosophers of this school are clearly of opinion that man, however created, was left to his own unaided exertions in the formation of an articulate language; but they are so intimately acquainted with the texture of human thought, that they find no difficulty in explaining the entire process which he must have followed. Dr Smith has ascertained that "the institution of nouns substantive" must have been one of the first steps towards the formation of language; and by another philosopher the geography of language is adjusted in a manner not less satisfactory: Rousseau thinks it highly probable that articulate speech must have taken its rise in islands, and must there have been carried to perfection before it was known on the continent.

Dr Doig was of opinion that "had all mankind, without exception, been once in a state of absolute savagism, they would not only have continued in that state, but would have still sunk lower and lower, till they had at last, in a manner, put off the character of humanity, and degraded themselves to the level of the beasts that perish." All the learning, religion, laws, arts, and sciences, and other improvements that have enlightened Europe, a great part of Asia, and the northern coast of Africa, were so many rays diverging from two points, on the banks of the Euphrates and the Nile. In proportion as nations receded from these two sources of humanity and civilization, in the same proportion were they more and more immersed in ignorance and barbarism. "I think it obvious, beyond all possibility of contradiction," he adds, "that all those

nations, and societies of men which were removed to a considerable distance from the grand sources of civilization above-mentioned, had early degenerated into a state of savagism; that this degeneracy increased exactly in proportion to their distance from those two points; that none of those nations who are known to have sunk into that state, ever became civilized, till they had renewed their correspondence with nations, or individuals, who had derived light and knowledge from the oriental sources;² that previous to the opening of this correspondence, no one people discovered the least propension or tendency towards culture and civilization; that, consequently, had all mankind been, at any one period, absolute savages, they would have continued in that unhappy state as long as the world existed; that if this train of reasoning should happen to be just, there must always have existed, in some part of the globe, a select society, a civilized race of men, among whom the knowledge of arts and sciences was always preserved, and from whom the blessings of civilization, and a cultivated state of life, were, in process of time, propagated to all the other nations, which at this day enjoy these invaluable benefits." This reasoning, supported with much ingenuity and learning, directly leads to the conclusion, which he leaves the reader to draw for himself, that the scriptural account of the primeval history of the human race is much more consonant with the principles of sound philosophy, than the account devised by the united wisdom of modern philosophers.

His next publication, which is of a very different description, bears the subsequent title: "Extracts from a Poem on the Prospect from Stirling Castle. I. The Vision. II. Carmore and Orma, a love Tale. III. The Garden. IV. The King's Knot. V. Three Hymns, Morning, Noon, and Evening." Stirling, 1796, 4to. The entire publication extends to 35 pages. As a specimen of his English versification, we transcribe a passage from the Vision, in which he introduces the shade of Wallace addressing King Robert the night before the battle of Bannockburn. The hero mentioned in the first verse is Sir John Graham.

Great was the hero's fall, when squadrons round
Mow'd by his well-try'd falchion strew'd the ground;
Thrice blest his envy'd fall, maturely dead,
Fresh laurels blooming round his sacred head!
While I by Faction's tumults rudely tost,
My country thrall'd, my patriot labours lost,
Betray'd, and basely sold, inglorious died,
The sport of perjur'd peers and tyrant pride.
Go, noble Bruce! fulfill thy happier fate,
On thee new glories smile, new triumphs wait:
To-morrow's sun, I see the fulgence rise,
Shall seal thy fame, and waft it to the skies;
To-morrow's sun shall blast yon barbarous host,
And chase the cloud that low'rs o'er Scotia's coast.
Dread not, great sire, their threats or boasted might,
Their skill in council or their fame in fight.
Now patriot blood, by impious Edward shed,
In flaming vengeance bursts o'er Edward's head:
Far round thy camp, array'd in blazing arms,
Thy Scotia's slaughtered heroes sound th' alarms;
On fiery steeds, unseen they watch the fray,
And spread terrific din, and pale dismay;
With dreams of conquer'd foes they fan the fire,
And bid ev'n dastard souls to fame aspire,

¹ Rousseau, Discours sur l'Origine et les Fondemens de l'Inégalité parmi les Hommes, p. 237. Amst. 1755, 8vo. "Je dis que quand de pareils observateurs affirmeront d'un tel animal que c'est un homme, et d'un autre que c'est une bête, il faudra les en croire; mais ce seroit une grande simplicité de s'en rapporter là dessus à des voyageurs grossiers, sur lesquels on seroit quelque fois tenté de faire la même question qu'ils se mêlent de résoudre sur d'autres animaux."

² Relative to the barbarism and civilization of Greece, the following passage occurs in the work of a very ancient philosopher: Πολυλακίς γὰρ καὶ γέγονε καὶ ἴσται βαρβαρος ἡ Ἑλλὰς, οὐχ ὑπ' ἀνθρώπων μόνον γινόμενη μεταναστατος, ἀλλὰ καὶ ὑπ' αὐτῆς τῆς φύσεως οὐ μαιζονος οὐδὲ μαινοῦς αὐτῆς γινόμενης, ἀλλὰ καὶ νοτίερας αὐτῆς, καὶ πρὸς ἡμᾶς ἀρχὴν λαμβάνουσης. (Ocellus Lucanus de Universi Natura, cap. iii. edit. Gale 1688.)

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With shields of proof thy half-arm'd bands protect,
Each random lance, each wav'ring shaft direct,
Till deeply sped, it reach the deadly wound,
And stretch some champion breathless on the ground,
Till heaps of carnage choak th' impurpled flood,
And all these fields are drench'd in hostile blood.
I see Caernarvon pale, aghast with fear,
Fly swift, great Douglas thundering in his rear:
Ill fare the faithless churl who shelter lends,
And homeward safe the trembling tyrant sends.

These are the only works which Dr Doig published in a separate form. For the reputation of authorship he appears to have felt no particular ambition: he was however an indefatigable student, and wrote many tracts which were never printed, which he probably had no intention of printing. He wrote an elaborate dissertation *On the Ancient Hellenes*, which appeared in the Transactions of the Royal Society of Edinburgh, vol. iii. He afterwards prosecuted the same subject, and transmitted his manuscript to one of the secretaries of the society; but on the decease of that gentleman, no vestige of it could be found among his papers. His contributions to the third edition of the present work, and particularly the article *Philology*, exhibit the most conspicuous monument of his erudition. In the articles *Mysteries* and *Mythology*, although they bear marks of the same hand, he has not taken so wide a range; but the article *Philology* is a long and elaborate treatise, distinguished by ingenuity as well as learning. "In addition," says Lord Woodhouselee, "to the most profound knowledge of the Greek and Latin languages, which he wrote with a classical purity, Dr Doig had successfully studied the Hebrew, Arabic, and other kindred dialects, and was deeply versed in Oriental literature." Of this variegated knowledge he has fully availed himself in his treatise on *Philology*. That portion of the *Encyclopædia Britannica* which contains it, was published in London during the same week with a tract on the Greek verb, written by Dr Vincent, afterwards dean of Westminster,¹ "who was so struck with the coincidence of Dr Doig's opinions on many points with his own, that he began an epistolary correspondence with the author; and these two eminent scholars went hand in hand in their researches, and in a free communication of their opinions, with a liberality of sentiment which did honour to both. Such likewise was the conduct of the learned Mr Bryant, who had entered into a correspondence with Dr Doig on the subject of ancient mythology."²

Dr Doig, who was married and left descendants, died on the 16th of March 1800, at the mature age of eighty-one. The following epitaph, written by himself, has been engraved on a marble monument erected to his memory by the town of Stirling, where he was respected for his worth, and admired for his learning:

Edidici quædam, perlegi plura, notavi
Pauca, cum domino mox peritura suo.
Lubrica Pieriæ tentarem præmia palmæ,
Credulus, ingenio heu nimis alta meo.
Extincto famam ruituro crescere saxo
Posse putem, vivo quæ mihi nulla fuit?

Of his Latin versification we subjoin a more considerable specimen, which relates to the erection of a monument to the memory of Buchanan.

En, Buchanane, pii, longo post tempore, cives
Ingenio statuunt hæc monumenta tuo.

Dolci.

Scotia te natum, te Gallia jactat alumnum,
Te canit Europe, qua plaga cunque patet.
Nil opus est saxo, nil indice: læta sonabunt
Carmine Levinium sæcula cuncta decus.
Seu decoras Latio divina poemata cultu,
Seu recinis nugas, ludicra, festa, sales,
Grandia seu tragico devolvīs verba cothurno,
Seu reseras varii claustra viasque poli,
Æmula seu captas Patavī præconia linguæ,
Fœdera dum patriæ, bella virosque refers,
Eloquio, gravitate, sono, vi, lumine, verbis,
Equiparas veteres, exsuperasque novos.
Quod Graii potuere simul, quod Romula virtus,
Tu solus numeris, arte, lepore potes.
Sin aliqua titubas patriæ labefactus amore,
Aut nimium vera pro pietate pius,
Ipsa notam lecti Libertas plorat alumni,
Ipsa tegit lauri Calliopea comis.
Sæpe nitor veri spissis latet obrutus umbris,
Nec semper Lynceus cuncta videnda videt.

Besides Latin and English poems, Dr Doig left an immense variety of works in manuscript. The subsequent list includes his most considerable treatises. 1. A rational Demonstration of the Divinity and Incarnation of Christ, 36 pp. fol. 2. The History of the Passion, 45 pp. 4to. 3. On Vicarious Punishments, 19 pp. fol. 4. Strictures on Dr Campbell's Translation of the Sermon on the Mount, 15 pp. 4to. 5. An Analysis of the Epistle to the Romans, 48 pp. fol. 6. An Analysis of the Epistle to the Hebrews, 60 pp. 4to. 7. A Dissertation on the Place where the Ark rested after the Deluge, 30 pp. fol. 8. An Essay on the Situation of Tarshish and Ophir, 66 pp. 4to. 9. A Dissertation on the Origin of Idolatry, 21 pp. 4to. 10. An Enquiry into the Origin of Statue-Worship, 84 pp. fol. 11. A Philological Dissertation on Chain and Remphan, 135 pp. fol. 12. A Philological Dissertation on the Gods of the Egyptians, 344 pp. 4to. 13. The History of the Titans, 146 pp. 4to. 14. On the Doctrine of Demons, 199 pp. 4to. 15. Letters on Mr Bryant's Ancient Mythology, 133 pp. fol. 16. An Essay on the Origin of the Greeks, 406 pp. fol. 17. Elucidations of Grecian Antiquities, 98 pp. 4to. 18. On the Origin of the Scots, 33 pp. 4to. 19. On the Origin of Language, 59 pp. fol. 20. Letters to Lord Kames on Language, 112 pp. fol. 21. Strictures on Dr Smith's Considerations on the Formation of Language, 33 pp. fol. 22. Letters to Dr Vincent on the Formation of Greek Verbs, 48 pp. fol. 23. An Essay on the Utility of the Learned Languages, 49 pp. 4to. 24. Figures of Rhetoric poetically described, 16 pp. 4to. (x.)

DOLAH, a town and district of Hindustan, in the province of Gujerat, ceded to the British in 1803. Long. 72. 25. E. Lat. 22. 47. N.

DOLCI, CARLO, or CARLINO, a painter of considerable celebrity, was born at Florence in 1616. He was a disciple of Jacopo Vignali, and when only eleven years of age he attempted a whole figure of St John, which received extraordinary approbation. He afterwards painted a portrait of his mother, and displayed a new and delicate style, which brought him into notice, and procured him extensive employment at Florence and other parts of Italy. Dolci appears to have used his pencil chiefly in sacred subjects, and bestowed much labour on his pictures. In his manner of working he was remarkably slow; and it is said of him that his brain was affected by seeing Luca Giordano dispatch more business in four or five hours

¹ On this subject, Dr Vincent published two different tracts. The Origination of the Greek Verb; an Hypothesis. Lond. 1794, 8vo. The Greek Verb analyzed; an Hypothesis, in which the Source and Structure of the Greek Language in general is considered. Lond. 1795, 8vo.

² Woodhouselee's Memoirs of Lord Kames, vol. ii. p. 142.

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than he could have executed in as many months. His works are consequently not numerous. He generally painted in a small size, although there are a few pictures by him as large as life. He died at Florence in 1686, leaving a daughter, Agnese, who also painted historical pieces, and arrived at some degree of excellence in copying the works of her father.

Carlo Dolci holds the same rank in the Florentine that Sassoferrato does in the Roman school. Without the possession of much genius or invention, both these artists produced pleasing and highly-finished pictures. The works of Dolci are easily distinguishable by the delicacy of the composition, and by an agreeable tint of colour, improved by judicious management of the chiaro-oscuro, which give his figures a surprising relief. "His pencil," says Pilkington, "was tender, his touch inexpressibly neat, and his colouring transparent; though he has often been censured for the excessive labour bestowed on his pictures, and also for giving his carnations more of the appearance of ivory than the look of flesh." All his best productions are of a devout description, and most frequently represent the patient suffering of Christ, or the sorrows of the Mater Dolorosa. In these the heads are marked with calm, intellectual beauty, and pathetic emotion, and are peculiarly expressive of pure and tranquil devotion. They are full of sensibility, and yet all unstained by earthly passion. There is, we allow, a want of character and deep shadowing in his pictures, but the colouring and general tone accord with the idea of the passion portrayed; nothing is turgid or bold, harsh or obtrusive; all is modesty, repose, and placid harmony. The best works of this master are the "St Sebastian;" the "Four Evangelists," at Florence; "Christ breaking the Bread," in the Marquis of Exeter's collection at Burleigh; and several smaller pictures, which are highly valued, and occupy honourable places in the richest galleries. (z. z.)

DOLE, in the Saxon and British tongue, signified a part or portion most commonly of a meadow where several persons had shares. It also still signifies a distribution or dealing of alms, or a liberal gift made by a great man to the people.

DOLE, an arrondissement in the department of Jura, in France, extending over 470 square miles. It is divided into nine cantons, and these into 155 communes, containing 65,380 inhabitants. The chief place, a city of the same name, is in a fine situation on the river Doubs, which winds its way through beautiful meadows. In the neighbourhood are many Roman antiquities, especially of roads and aqueducts. The canal for uniting the Doubs with the Rhone, projected by Bonaparte, commences at this city. It contains 1350 houses, and 8235 inhabitants. It is in long. 5. 25. E. and lat. 47. 2. 45. N.

DOLE, in *Scotch Law*, from the Latin *dolus*, signifies a malevolent intention. It is essential in every crime, that it be committed intentionally, or by an act of the will; and hence the rule, *Crimen dolo contrahitur*.

DOLIAH, a town of Hindustan, in the province of Gujerat, thirty-three miles north-east from Cambay, possessed by independent chiefs. Long. 72. 26. E. Lat. 22. 47. N.

DOLLAR, or THALLER, a silver coin nearly of the value of the Spanish piece of eight, or French crown. Dollars are coined in different parts of Germany and Holland, and have their diminutions, as semi-dollars, quarter-dollars, and the like. See MONEY.

DOLLOND, JOHN, a practical and theoretical optician of the highest celebrity, the discoverer of the laws of the dispersion of light, and inventor of the achromatic telescope, descended from a family of French refugees, was born in London on the 10th June 1706.

His first destination was the manufactory which afforded

employment to the greater part of the French colony established in Spitalfields, and he passed some of his earlier years in the mechanical labour of a silk-weaver. He was, however, always attached to the mathematics and to natural philosophy, and he even extended his studies to the outlines of anatomy and of scholastic divinity; and in the pursuit of these objects he found himself obliged to acquire a competent knowledge of the Latin and Greek languages, a task which was much facilitated to him by the possession of a memory no less retentive than his observation was accurate and his reasoning correct. He married early, and he continued in his first occupation till he had established his eldest son, Peter Dollond, who inherited his own tastes as an optical instrument maker; and the success of the undertaking was such as to induce him, in 1752, to leave his own business, and to enter into partnership with his son in Vine Court.

These arrangements having taken place, it was not long before Mr Dollond communicated to the Royal Society some of the results of the application of his inventive powers to his new pursuits; and Mr Short, who then enjoyed the highest reputation as an optician, paid him the compliment of bringing them forward to the Society under the auspices of his name.

1. *A Letter to Mr James Short, F. R. S. concerning an Improvement of Refracting Telescopes.* *Phil. Trans.* 1753, p. 103. The author here describes a telescope with six glasses, as calculated for correcting, either wholly or in great measure, the errors of refraction arising from the dispersion of the different colours, as well as from the spherical form of the surfaces of the eye-glasses; appealing to the superiority of the telescopes which he had thus constructed, to those which had before been in use; but he reserves a more ample detail of the theory for a future occasion, which, however, does not appear to have presented itself, the improvement having been superseded by others incomparably more important.

2. *A Letter to James Short, A. M. F. R. S. concerning a Mistake in Mr Euler's Theorem for correcting the Aberration in the Object Glasses of Refracting Telescopes;* read 23d November 1752; together with an introductory letter of Mr Short, in which Euler's calculations are somewhat too categorically condemned, and with Euler's answers to Short and Dollond. *Phil. Trans.* 1753, p. 287. It is remarkable with what profound respect the experiments of Newton are treated in Mr Dollond's letter: "It is somewhat strange," he says, "that any body now-a-days should attempt to do that which so long ago has been demonstrated impossible." But although the investigation of truth was perhaps in this instance retarded, yet its ultimate discovery was not prevented by a just deference to a high authority. Euler was, however, certainly right in considering the law which he had assumed as sufficiently compatible with the results of Newton's experiments; although he was much mistaken in his conjectures respecting the achromatic properties of the eye.

3. *A Description of a Contrivance for Measuring Small Angles.* *Phil. Trans.* 1753, p. 178. This apparatus consists of a divided object-glass, with a scale for determining the distance of the images, by measuring the linear displacement of the two portions of the glass, which subtends the same angle from the focus of parallel rays, as the actual distance of the images does from the object-glass. The apparatus is recommended as particularly calculated to be applied to a reflecting telescope, and was afterwards adapted by Mr Peter Dollond to the improved achromatic telescopes. Mr Savery and Mr Bouguer had before used two separate lenses in a manner nearly similar; but the employment of a single glass divided affords a much more convenient arrangement.

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4. *An Explanation of an Instrument for Measuring Small Angles.* *Phil. Trans.* 1754, p. 551. This paper contains a more detailed theory of the divided object-glass micrometer, and a testimony of its utility from Mr Short, founded on actual experiments.

5. *An Account of some Experiments concerning the Different Refrangibility of Light.* *Phil. Trans.* 1758, p. 733.

We have here the important results of a series of accurate experiments, by which the author had undertaken to investigate the foundations of the Newtonian theory of refraction; though he began them without any hope of a success so brilliant as that which ultimately crowned his labours.

It was in the beginning of 1757 that Mr Dollond made the decisive experiment of putting a common prism of glass into a prismatic vessel of water, and varying the angle of the vessel till the mean refraction of the glass was compensated; when he found that the colours were by no means destroyed, as they were supposed to have been in a similar experiment related by Newton; for the remaining dispersion was nearly as great as that of a prism of glass of half the refracting angle. Mr Dollond then employed a thinner wedge of glass, and found that the image was colourless when the refraction of the water was about one fourth greater than that of the glass. He next attempted to make compound object-glasses by inclosing water between two lenses; but in this arrangement he found great inconvenience from the spherical aberration; so that he was obliged to try the effects of different kinds of glass, and he fortunately discovered that the refractions of flint and crown glass were extremely convenient for his purpose, the image afforded by them being colourless when the angles were to each other nearly as two to three; and hence he inferred that a convex lens of crown glass and a convex one of flint would produce a colourless image when their focal distances were in the same proportion. The spherical aberration, where the curvature was so considerable, still produced some inconvenience; but having four surfaces capable of variation, he was enabled to make the aberrations of the two lenses equal; and since they were in opposite directions, they thus corrected each other. All these arrangements required great accuracy of execution for their complete success; but, in the hands of the inventor, they produced the most admirable instruments, and he was singularly fortunate in obtaining a quantity of glass of more uniform density than has been since manufactured on so large a scale. He afterwards made some small Galilean telescopes with triple object-glasses, and Mr Peter Dollond applied this construction to the longer telescopes with compound eye-pieces, the alteration rendering the spherical aberration still more manageable.

The merits of Mr Dollond's inventions were promptly acknowledged on the part of the Royal Society by the adjudication of the Copleyan medal for the year. In 1761, he was appointed optician to the king, and was elected a fellow of the Royal Society; a distinction which is often obtained on easy terms by those whose situation in life exempts them from the suspicion of seeking it for any purpose degrading to science, but which is generally an object of considerable ambition to persons of mechanical or commercial occupations.

A considerable share of the credit due to Mr Dollond's discoveries has been very erroneously attributed by some late historians and biographers on the Continent to Leonard Euler, a mathematician who most assuredly has little need of the appropriation of the merits of others to establish his claim to immortality. But in fact the only idea of Euler that could be said to have furnished any hint to Mr Dollond, has been shown by the calculations of Dr

Maskelyne, and by the experiments of Dr Thomas Young Dolomieu. and Dr Wollaston, to have been completely erroneous; nor did Euler even admit the accuracy of Mr Dollond's conclusions after his discovery was made, without considerable hesitation and scepticism. Mr Klingenstierna had simply expressed a doubt with respect to the result of Newton's experiments, though he by no means suspected the extent of the error. Mr Peter Dollond has sufficiently vindicated his father's claim to complete originality, in a paper read to the Royal Society in the year 1789; he has also suggested an explanation of the origin of Newton's mistake, by stating that there exists a kind of Venetian glass, of which the dispersive power little exceeds that of water, whilst its specific gravity nearly approaches to 2.58, which is assigned by Newton to glass in general; and it certainly seems more probable that some such circumstance as this was the cause of the error, than that Newton should, as some have suspected, have mixed acetate of lead with the water which he used, for an experiment which was so much more likely to be satisfactory without it.

Mr Dollond's appearance was somewhat stern, and his language was impressive, but his manners were cheerful and affable. He was in the habit of attending regularly, along with his family, the service of the French Protestant church. He constantly sought his chief amusement in objects connected with the study of those sciences which he had so much contributed to improve. Perhaps, indeed, he pursued them with an application somewhat too intense; for on the 30th of November, as he was reading a new work of Clairaut on the theory of the moon, which had occupied his whole attention for several hours, he had an attack of apoplexy, which shortly became fatal. He left two sons and three daughters. His sons succeeded to his business; and the younger dying a few years afterwards, his place was filled by a nephew, who assumed the family name, and who still conducts the establishment with undiminished respectability and success. (*Kelly's Life of John Dollond, with an Appendix of all the Papers referred to*, 3d edit. 4to, Lond. 1808.) (L. L.)

DOLOMIEU, DEODATUS GUY SILVANUS TANCRED DE GRATET DE, a distinguished mineralogist and geologist, son of Francis de Gratet de Dolomieu, and Frances de Berenger, was born on the 24th of June 1750, in the province of Dauphiné.

He was admitted a member of the order of Malta during his earliest infancy, as if he had been devoted from his cradle to glory and to misfortune. At eighteen he embarked in one of the galleys belonging to the order, and soon afterwards unhappily found himself under the necessity of fighting a duel, in which his adversary fell. The laws condemned him to die, but he received a pardon from the grand master; it was, however, necessary that it should be approved by the pope, who for a long time refused to confirm it, notwithstanding the solicitations of several European powers in behalf of the offender, until his consent was at last obtained by the Cardinal Torregiani. Dolomieu, in the mean time, was closely imprisoned in the island for nine months, and this period of solitude seems to have contributed materially to increase the seriousness of his character, and to confirm him in a contemplative turn of mind.

At the age of twenty-two he went to Metz as an officer in the regiment of carabineers, in which he had held a commission for seven years; and he displayed great courage and personal activity on occasion of an accidental conflagration which occurred soon afterwards. His leisure hours were employed in the study of chemistry and natural history, with the assistance of Mr Thirion, an apothecary residing in this city. About the same time he also

Dolomieu. became intimate with De la Rochefoucault, with whom he maintained an unshaken friendship ever after.

1. He commenced his literary career with an *Italian translation of Bergman's Work on Volcanic Substances*, to which he added some *Notes*, and some observations on the *classification* of those substances.

2. He also furnished some *Notes* to a translation of Cronstedt's *Mineralogy*.

3. In 1775 he published *Researches on the Weight of Bodies at different distances from the Earth's Centre*; and upon the recommendation of La Rochefoucault, was made a correspondent of the Academy of Sciences at Paris. This compliment seems to have contributed to his determination to relinquish his prospects of success in the army, and to devote himself exclusively to science. Having resigned his commission, he commenced his geological labours with a tour in Sicily, Italy, and Switzerland.

4. This expedition afforded him the materials for his *Voyage aux Iles de Lipari, fait en 1781*, which he published in 1783, with some other tracts. He describes a singular kind of volcano at Macaluba, in Sicily, formed by air bubbling up from the crater, and causing its contents to overflow. The *Essay on the Climate of Malta* is rendered inconclusive by the imperfection of the eudiometrical apparatus that was then commonly employed.

5. He spent a part of the same year in examining the effects of the earthquake in Calabria, which are described in his *Mémoire sur les tremblemens de Terre de la Calabrie*, 8vo, Rome, 1784. Among other observations, he notices the singular fact, that all those parts of Calabria to which the earthquake extended are of a calcareous nature, without any traces of volcanic substances.

6. He published, in the *Journal de Physique*, vol. xxv. p. 191, a paper on the extinct volcanoes of the Val di Noto in Sicily.

7. His *Mémoire sur les Iles Ponces*, 1788, contains also a catalogue of the productions of Mount Etna, and an account of the eruption of 1787.

At the beginning of the revolution Dolomieu embarked, together with his friend La Rochefoucault, in that which appeared to be the cause of liberty. He was in Paris on the 14th of July, but he did not accept of any office under the newly-modified government. La Rochefoucault soon fell a victim to the horrors of the times. Dolomieu was present in his last moments, and received the affectionate messages which he sent to his mother and his wife, who were more distant witnesses of the dreadful scene.

8. No longer hoping for any benefit to his country from the political events of the day, he appears to have resumed his geological studies in other parts of Europe. In a *Letter on the Origin of Basalt*, dated Rome, 1790, *Journ. Phys.* vol. xxxvii. p. 193, he considers some stones of this description, for instance, the black trapps of Saxony, as the productions of water; and others, particularly the varieties found in the south of Europe, as of volcanic origin.

9. He writes, in 1791, a *Letter from Malta*, describing a species of limestone found in the Tyrol, hard enough to become phosphorescent upon collision, and not effervescing with acids until powdered. It was afterwards called the Dolomite. *Journ. Phys.* vol. xxxix. p. 3.

10. In a paper of *Directions for Naturalists*, he gives some useful advice to the circumnavigators about to sail to the South Seas. *Journ. Phys.* vol. xxxix. p. 310.

11. A series of his essays *On Compound Stones and Rocks* appeared from time to time in the *Journal de Physique*, vol. xxxix. p. 374; vol. xl. p. 41, 203, 372. In these he insists on the necessity of supposing that the ocean must have acted with great violence in reducing the continents into their present state; neither the slow subsidence of a general deluge, nor the continued action of ordinary

rivers, being sufficient to explain the phenomena; and he remarks, that a violent agitation, such as must necessarily be supposed to have taken place, would naturally cause several alternations in the state of the waters, like immense waves or tides, which must have contributed to the modifications impressed on the earth's form. Indeed, the facts which support this opinion appear to be so obvious and so numerous, that it is difficult to understand how the opposite hypothesis should ever have become popular.

12. In the same volume there is a short paper *On Petroleum found in Rock Crystal*, and on some elastic fluids obtained from it, p. 318.

13. The progress of his memoirs was now interrupted by the proscription, in which many of the best and wisest of his countrymen were indiscriminately involved. "His duty and his inclination," he says, in a *Note* without a date, "required the devotion of his time and his arm to the defence of his king;" and he was obliged to submit to a temporary dereliction of his pursuits of science. P. 481.

14. But the cause was hopeless, and it was impossible for him to render it any essential service. He soon resumed his pen, and took occasion to express, with great spirit and energy, his political feelings, in his *Memoir on the Physical Constitution of Egypt*. *Journ. Phys.* vol. xlii. p. 41, 108, 194. In Egypt, he observes, there are many calcareous rocks and sands, which cannot have been brought down by the Nile; but there is also much of the soil which has the appearance of having been derived from the mud, with an admixture of sand only. The same cause, he thinks, may possibly have raised the bed of the river, so that the relative height of the inundations may have been little altered. He conceives that the Delta has increased even in modern times, though far less rapidly than it appears to have done formerly; for he is disposed to admit the credibility of the Homeric account of the distance of the Pharos from the continent, although he attempts to explain a part of the supposed change by the filling up of the lake Mareotis only; and, on the whole, he imagines that about a thousand square leagues of the surface of Egypt have been gained from the sea. He has not, however, thought it necessary to discuss the arguments which Bruce and others have brought against the established opinion, and against the facts asserted by Herodotus in its support; although some of the best informed of modern travellers have allowed the accuracy of Bruce's statements relating to this subject.

15. In a short paper *On the Figured Stones of Florence*, Mr Dolomieu attributes the appearance of the arborescent and architectural figures which characterize them, to the process of slow decomposition and oxidation, gradually producing the stains in the extremely minute fissures, which favour these changes. *Journ. Phys.* vol. xliii. p. 285.

16. Upon the establishment of the school of Mines, in 1795, he accepted the situations of professor of geology and inspector of mines. He was also made one of the original members of the National Institute of Sciences and Arts, then organized by a law of the existing government. From this time he appears to have redoubled the energy with which he had before laboured in the pursuit of natural knowledge, and he published a great number of memoirs in the course of a very few years. One of the first of these consisted of *Observations on a pretended Coal Mine, called the Désirée*. *Journal des Mines*, year iii. N. ix. p. 45.

17. His *Methodical Distribution of Volcanic Substances* appeared in the new *Journal de Physique*, vol. (i.) xliii. p. 102, 175, 241, 406; vol. (ii.) xlv. p. 81. Of the five classes which he had before proposed in his notes on Bergman, the first comprehends substances actually pro-

Dolomieu. duced by volcanoes; the second, substances thrown out by them unaltered; the third, bodies altered by the volcanic vapours; the fourth, bodies altered in the moist way; and the last, substances illustrative of the history of volcanoes only. The subsequent papers are partly continuations of the *Mémoires on Compound Rocks*; and they also relate particularly to the nature of lavas, some of which are shown to be formed from argillaceo-ferruginous stones. The heat of lavas has been pretty accurately entertained, in some cases, by the fusion of silver coins exposed to it, whilst those of copper remained entire; there is, however, an account of a stream of lava over which some nuns are stated to have walked while it was yet fluid; and this circumstance Mr Dolomieu attributes to a mixture of sulphur, which remained melted at a temperature comparatively low. Some objections to this opinion have, however, been advanced by Mr Sage. *Journ. Phys.* vol. xlv. p. 281. *An Explanation of the New Method adopted in the Description of Minerals* was also published in the *Magazin Encyclopédique*, vol. i. p. 35.

18. Among the shorter essays of Mr Dolomieu, we find a *Description of the Beryl*. *Journ. des Mines*, year iv. Ventose, p. 11.—19. *Description of the Mine of Manganese at Romanèche*. Germinal, p. 27.—20. *Letter on the Heat of Lavas*. Messidor, p. 53.—21. *On Quartzose Concretions*, p. 56.—22. *On Ancient Lithology*. *Mag. Enc.* i. p. 437.—23. *Description of the Emerald*, ii. p. 17, 145.—24. *A Letter from Berlin on the Magnetic Serpentine*, ii, vol. vi. p. 7.—25. *On the Leucite, or White Garnet*. *Journ. des Mines*, year v. p. 177.—26. *On the Necessity of Chemical Knowledge to a Mineralogist, and on the term Chrysolith*, p. 365.

27. *An Introductory Discourse on the Study of Geology* appears in the *Journal de Physique*, vol. xlv. p. 256. It was preliminary to a course of lectures on the natural position of minerals, and it contains good and detailed directions for the use of students, with some eloquent advice on the benefits of travelling, and on the merits of temperance and simplicity of manners.

28. In the next volume, p. 203, our author announces the *Discovery of the Crystallized Sulphate of Strontia in Sicily*. It had before been found uncrystallized in France.

29. *On Colour as a Characteristic of Stones*. *Journ. Phys.* vol. (iii.) xlv. p. 302. This essay contains some objections to Werner's habit of relying too implicitly on colour, and the white tourmaline of St Gothard is adduced as an instance of the triumph of form over complexion; a just tribute of commendation is also paid to the merits of Haüy.

30. A paper *On the Pyroxene, or Volcanic Schörl*, is chiefly destined to support the opinion that such crystals have been formed previously to the existence of the volcano, by the observation of a specimen found adhering to a rock which had never undergone the effect of fire. *Journ. Phys.* vol. xlv. p. 306.

31. *A Memoir read to the Institute* contains the report of Mr Dolomieu's mineralogical tours, made in the years 1797 and 1798. *Journ. Phys.* vol. xlv. p. 401. *Journ. des Mines*, year vi. p. 385. He visited the south of France, the Alps, and the neighbouring lakes and mountains, almost always on foot, and with his hammer in his hand, accompanied by Brochart, Cordier, Bonniers, and his brother-in-law the Marquis de Drée. From his observations in Auvergne, in particular, he concludes that the foundation or origin of the volcanoes there is certainly below the granite rocks, which therefore cannot, properly speaking, be called primitive; and he proceeds to a much bolder and less admissible conjecture, that the central parts of the globe are at present in a state approaching to fluidity, which he attempts to support by the ready transmission of the shocks of earthquakes to distant places; and he even quotes the

authority of Lagrange as having been disposed to encourage the opinion. Volcanoes, in general, he divides into ancient and modern, as separated by the intervention of the changes which have reduced the continents to their present form. With respect to the heat of the lava, he observes, that it has not been sufficient to expel the carbonic acid from the limestone which has been exposed to it. He also remarks, that, where basalt in fusion has been suddenly cooled by water, the contraction has caused it to divide into columns, which are not crystalline, because their angles are irregular, and which are smaller and more uniform in proportion as the water is deeper. He contrasts the horizontal strata of France with the vertical tables of the Alps, and particularly describes the accretion of a mantle of calcareous substances, two miles in height, which has attached itself to the north-east faces of the Alps, subsequently to their first formation as mountains. From this expedition he brought home an immense collection of rocks and stones, principally valuable for their arrangement with a view to the illustration of his particular doctrines in geology, which, with the rest of his cabinet, have since formed a part of the superb museum of M. de Drée.

32. He published, about the same time, a paper *On the Mountains of the Vosges*. *Journ. des Mines*, year vi. p. 315.

33. *Extract of a Report on the Mines of the department of the Lozère*, p. 577.

34. The only communication of Mr Dolomieu printed in the *Memoirs of the Institute*, is rather on a mechanical than a mineralogical subject, containing an *Account of the Art of Making Gun-Flints*. *M. Math.* vol. iii. p. 348. *Nicholson's Journal*, 8. vol. i. p. 88.

He was engaged, after his return from Switzerland, in some mineralogical contributions to the *Encyclopédie Méthodique*, when he was invited to take a part in the scientific arrangements of the expedition to Egypt. He did not, however, strictly confine himself to this department, but was successfully employed as a negociator for the surrender of Malta. In Egypt he visited the pyramids, and examined some of the mountains which form the limits of the country, but his health soon compelled him to return to Europe. In this voyage the vessel on board of which he had embarked was nearly overwhelmed by a tempest, and appears to have been only saved by the temporary expedient of throwing overboard pounded biscuit mixed with straw, which entered the leaks with the water, and afforded a partial remedy, which was repeated from time to time, until the vessel, at the last extremity, was driven into a port in the Gulf of Tarentum. The counter-revolution of Calabria had occurred but a few days before, and Dolomieu, with his companion Cordier, and many others of his countrymen, were thrown into prison, and they even owed their lives to the great exertions of an individual among the insurgents in their favour. They were afterwards removed to Sicily, but with the loss of their collections and their manuscripts; and Dolomieu being denounced, as a member of the order of Malta, for high treason, was separated from his countrymen, and closely confined in a dungeon. Solicitations were addressed to the king of Naples on his behalf, by the National Institute, by the French government, by the king of Spain, and in the name of the Royal Society of London, although its illustrious president was certainly not "at the time in Sicily," as the *Nouveau Dictionnaire Historique* affirms; but the captive derived essential assistance from the good offices of an English gentleman at Messina, and some Danes accommodated him in his pecuniary arrangements. Whilst still a prisoner, he was appointed successor to Daubenton, at the Museum of Natural History; and the very circumstance of his captivity seemed to give him an advantage

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Dolorskoi over his competitor. In the treaty made by the French with the king of Naples, after the battle of Marengo, it was expressly stipulated that Dolomieu should be set at liberty.

35. Upon his return to Paris he was made a member of the Conservative Senate, and he delivered soon afterwards a course of lectures on the philosophy of mineralogy. He had written part of an essay on this subject during his imprisonment in Sicily, with a bone for a pen, and a mixture of soot and water instead of ink, on the margins of such books as were allowed him; and his last publication was *Sur la Philosophie Minéralogique, et sur l'espèce Minéralogique*. Paris, 1801. His classification depended on considering the species as determined by the integrant molecule, and on arranging the different external forms as varieties, whether regular as modifications, or irregular as imperfections; besides the variations of colour and appearance, and the more essential affections of the consistence of the substance, which may be called contamination; but the whole essay may be considered as rather of a logical than of a physical nature.

After the delivery of his lectures, he set out upon a new expedition to his favourite mountains, in company with Mr Neergard and Mr d'Eymar, who published an account of the journey. Paris, 1802. He meditated a tour into Germany and to the north of Europe; but his return to Paris was interrupted by indisposition, when he had arrived, by way of Lyons, at Chateaufort, where he met his sister and his brother-in-law, and this journey was his last.

The merits of Dolomieu consisted as much in his personal character as in his scientific attainments. His conversation was modest, though his courage was heroic; his manners were simple though refined; and though his talents were considerable, they seem to have been surpassed by his industry. It has been remarked, that he often undertook more than he had any reasonable prospect of completing; but, in the mean time, he was perhaps as happy in the pursuit as he would have been in the attainment of his object. He died, universally regretted, at Drée, near Maçon, on the 27th of November 1801, in the midst of his affectionate family, who had been the partakers in his pursuits, and the consolation of his misfortunes.

Lacépède, *Notice Historique sur la Vie et les Ouvrages de Dolomieu*; *Mém. Math. Inst.* vol. vii. 1806, p. 117; Chalmers's *Biographical Dictionary*, vol. xi. 8vo, London, 1818. (L. L.)

DOLORSKOI, a fortress of Asiatic Russia, in the province of Kolhyvane, situated on the river Irkutsk, sixteen miles west from Semipolatoi.

DOLPHIN ISLANDS, three small islands in the Mergui Archipelago, near the north-east coast of Sullivan's Island. Lat. 11. 14. N.

DOLPHIN of the Mast, a peculiar kind of wreath, formed of plaited cordage, to be fastened occasionally round the masts, and the use of which is to sustain the weight of the fore and main yards, in case the rigging or chains by which these yards are suspended should be shot away in the time of battle, a circumstance which might render the sails useless at a season when their assistance is most necessary.

DOLSCHY, a circle in West or Little Wallachia. It is watered by the river Schui, which is divided into two branches, and forms a large island. It contains one city, Krajowa, one market-town, and sixty-four villages.

DOM, or DON, a title of honour, invented and chiefly used, the former by the Portuguese, the latter by the Spaniards. It is an abbreviation of *dominus*, and signifies *sir* or *lord*.

This title, it seems, was first given to Pelayo, in the

beginning of the eighth century. In Portugal no person can assume the title of *Dom* without the permission of the king, since it is looked upon as a mark of honour and nobility. In France it is sometimes used among the religious.

DOM AND SOM, in old charters, signifies full property and jurisdiction.

DOMAT, or DAUMAT, JOHN, a celebrated French juriconsult, born in 1625. Having observed the confused state of the laws, he digested them in four volumes 4to, under the title of *Lois Civiles dans leur Ordre Naturel*; an undertaking for which Louis XIV. settled on him a pension of two thousand livres. Domat was intimate with the famous Pascal, who left him his private papers at his death. He himself died in 1696. Besides the *Lois Civiles*, Domat made in Latin a selection of the most common laws in the collections of Justinian; but this work did not appear until after his death, when it was published separately, under the title of *Legum Delectus*. Subsequently, however, it was united with the *Lois Civiles*. Domat may be regarded as the restorer of reason in jurisprudence.

DOME, in *Architecture*, a spherical roof, or a roof of a spherical form, raised over the middle of a building, as a church, hall, pavilion, vestibule, staircase, or the like. See the article ARCH.

DOOM, or *Doom*, signifies judgment, sentence, or decree. The homagers' oath in the black book of Hereford ends thus: "So help me God at his holy dome, and by my trowthe."

DOMEA, a town in the kingdom of Tungquin, situated inland on the Tungquin river. It had a considerable trade in the seventeenth century, and was frequented by a number of Dutch vessels. Long. 106. E. Lat. 20. 40. N.

DOMENICHINO, or DOMENICO, LAMPIERI, the celebrated painter, was born at Bologna in 1581. He was placed when young under the tuition of Denis Calvart; but having been treated with great severity by that master, he left him, and became a pupil in the academy of the Caracci, where he remained for a long time. The genius of Domenichino was slow in its development. He was at first timid and distrustful of his powers; whilst his studious, thoughtful, and reserved manners were misunderstood by his companions for dullness. But the intelligent Annibal Caracci, who observed his faculties with more attention, and knew his abilities better, testified of Domenichino that his apparent slowness of parts would in time produce what would be an honour to the art of painting. When his early productions had brought him into notice, he studied with incredible application, and made such advances in painting as to raise his works into a comparison with those of the most admired masters. From his acting as a continual censor of his own works, he became amongst his fellow pupils the most accurate and expressive designer; his colours were the truest to nature, and of the best *impasto*, and he proved the most universal master in the theory of his art; in short, the only painter amongst them all, in whom Mengs found nothing to desire, except a somewhat larger proportion of elegance. That he might devote his whole being to the art, Domenichino shunned all society, or if he occasionally sought it in the public theatres and walks, it was in order better to observe the play of the passions in the features of the people,—those of joy, anger, grief, terror, and every affection of the mind, and to commit them vividly to his tablets; and thus, says Belloni, it was that he succeeded in delineating the soul, in colouring life, and calling forth heartfelt emotions, at which his works all aim, as if he waved the same wand which had belonged to the poetical enchanters Tasso and Ariosto.

After several years' severe study at Bologna, Domenichino went to Parma, in order to examine the beautiful

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works of the Lombards, and thence proceeded to Rome, where he assisted Annibal Caracci, and obtained employment through his recommendation from Cardinals Borghese, Farnese, and Aldobrandi, for all of whom he painted works in fresco, which were justly admired. The distinguished reputation which he had acquired excited the jealousy of some of his contemporaries, who represented his very excellencies as defects. Lanfranco in particular, one of his most inveterate enemies, asserted that his Communion of St Jerome was an imitation from Agostino Caracci, and procured an engraving of this master's picture of the same subject, copies of which were circulated for the purpose of showing up Domenichino as a plagiarist. But this stratagem only tended to expose the calumnious intents of his rivals, as it was evident that there was no other resemblance in the compositions than what must necessarily be the case in the pictures of two artists treating the same subject; and that every essential part, and all that was admired in the work, were entirely his own. If it had been possible for the exertions of modest merit to have repelled the shafts of slander, the pictures which he painted immediately afterwards, representing subjects from the life of St Cecilia, might have silenced the attacks of envy and malevolence; but they only increased the alarm of his competitors, and redoubled their injustice and malignity. Disgusted with these cabals, Domenichino left Rome for Bologna, where he remained until he was recalled by Pope Gregory XV., who appointed him principal painter and architect to the pontifical palace. But the persecutions of his enemies continued unabated, and are said to have absolutely wearied out his life. He died, not without suspicion of being poisoned, in 1641.

Domenichino, in correctness of design, expression of the passions, and simplicity and variety in the airs of his heads, is allowed to be little inferior to Raffaello. "We must," says Lanzi, "despair to find paintings exhibiting richer or more varied ornaments, accessories more beautifully adapted, or more majestic draperies. The figures are finely disposed both in place and action, conducing to the general effect; whilst a light pervades the whole, which seems to rejoice the spirit, growing brighter and brighter in the aspect of the best countenances, whence they first attract the eye and heart of the beholder." The persons delineated could not tell their tale to the ear more plainly than they speak it to the eye. The Scourging of St Andrew, which he executed in competition with Guido at Rome, is a powerful illustration of this truthful expression. Of the two works of these masters, Annibal Caracci preferred that of Domenichino. It is said that in painting one of the executioners the artist actually threw himself into a passion, using threatening words and actions, and that Annibal Caracci surprising him at that moment, embraced him, exclaiming with joy, "To-day, my dear Domenichino, thou art teaching me." "So novel," remarks Lanzi, "and at the same time so natural, it appeared to him, that the artist, like the orator, should feel within himself all that he is representing to others." Domenichino is universally esteemed as the most distinguished disciple of the Caracci. Algarotti prefers him to the greatest masters; and Nicolo Poussin considered him as the first painter after Raffaello. His pictures of the Communion of St Jerome, Adam and Eve, and the Martyrdom of St Agnes, are esteemed amongst his best works. Domenichino was unrivalled in his frescos. He excelled also in landscape painting. In that style the beauty arising from the natural and simple elegance of his scenery, his trees, his well-broken grounds, and in particular the character and expression of his figures, gained him as much public admiration as any of his other performances.

The worth of Domenichino, as Agucchi foretold, was Domesday. never rightly appreciated during his lifetime. But the spirit of party which set in so strongly against him whilst living, soon passed away when he was no more; and impartial posterity has done justice to the talents of this illustrious painter, whose works are in the highest esteem, and fetch enormous prices. (z. z.)

DOMESDAY or DOOMSDAY BOOK, a most ancient record, made in the time of William the Conqueror, and containing a survey of all the lands of England. It consists of two volumes, namely, a greater and a less. The first is a large folio, written on 382 double pages of vellum, in a small but plain character, each page having a double column. Some of the capital letters and principal passages are touched with red ink, and some have strokes of red ink run across them, as if scratched out. This volume contains the description of thirty-one counties. The other volume is in quarto, written upon 450 double pages of vellum, but in a single column, and in a large but very fair character. It contains the counties of Essex, Norfolk, Suffolk, part of the county of Rutland, included in that of Northampton, and part of Lancashire, in the counties of York and Chester.

This work, according to the red book in the exchequer, was begun by order of William the Conqueror, with the advice of his parliament, in the year 1080, and completed in the year 1086. The reason given for taking this survey, as assigned by several ancient records and historians, was, that every man should be satisfied with his own right, and not usurp with impunity what belonged to another. But besides this, it is stated by others, that all those who possessed landed estates now became vassals to the king, and paid him so much money by way of fee or homage, in proportion to the lands they held; a circumstance which appears very probable, as there was at that time extant a general survey of the whole kingdom, made by order of King Alfred.

For the execution of this survey recorded in Domesday-book, commissioners were sent into every county and shire, and juries summoned in each hundred, out of all orders of freemen, from barons down to the lowest farmers. These commissioners were to be informed by the inhabitants, upon oath, of the name of each manor and that of its owner, also by whom it was held in the time of Edward the Confessor; the number of hides; the quantity of wood, of pasture, and of meadow land; how many ploughs were in the demesne, and how many in the tenanted part of it; how many mills, and how many fish-ponds or fisheries belonged to it; the value of the whole in the time of King Edward, as well as when granted by King William, and at the time of this survey; and also whether it was capable of improvement or of being advanced in value. They were likewise directed to return the tenants of every degree, the quantity of lands then and formerly held by each of them, what was the number of villeins or slaves, and also the number and kinds of their cattle and live stock. These inquiries being first methodized in the county, were afterwards sent up to the king's exchequer.

This survey, at the time when it was made, gave great offence to the people, and occasioned a suspicion that it was intended for some new impost. But notwithstanding all the precaution taken by the Conqueror to have the survey faithfully and impartially executed, it appears that a false return was given in by some of the commissioners, probably, as is alleged, from a pious motive. This was particularly the case with the abbey of Croyland in Lincolnshire, the possessions of which were greatly underrated, both with regard to quantity and value. Perhaps more of these pious frauds were discovered, as it is said Ralph Flambard, minister to William Rufus, proposed

Domestic. making a fresh and more rigorous inquisition; but this was never carried into operation.

Notwithstanding the proof of its falsehood in some instances, which must throw a suspicion on all others, the authority of Domesday-book was never permitted to be called in question; and when it has been necessary to distinguish whether lands were held in ancient demesne or in any other manner, recourse was always had to Domesday-book, and to it only, in order to determine the doubt. From this definitive authority, from which, as from the sentence pronounced at domesday, or the day of judgment, there could be no appeal, the name of the book is said to have been derived. But Stowe assigns another reason for this appellation, namely, that Domesday-book is a corruption of "*domus Dei* book;" a title given it because heretofore it was deposited in the king's treasury, in a place of the church of Westminster or Winchester called *domus Dei*. From the great care formerly taken to preserve this survey, we may learn the estimation in which it was held. In the dialogue de Sacramentis it is said, *Liber ille* (meaning Domesday-book) *sigilli regis comes est individuus in thesauro*. Until latterly it has been kept under three different locks and keys; one in custody of the treasurer, and the others in that of the two chamberlains of the exchequer. It is now deposited in the chapter-house at Westminster, where it may be consulted, on paying to the proper officers a fee of six-and-eightpence for a search, and fourpence per line for the matter transcribed from it.

Besides the two volumes above mentioned, there is also a third made by order of the same king, and which differs from the others in form rather than in matter. There is likewise a fourth, which is kept in the exchequer, and which, though a very large volume, is only an abridgment of the others. In the remembrancer's office in the exchequer there is kept a fifth book, also called Domesday, which is the same with the fourth book already mentioned. King Alfred had a roll which he called Domesday; and the Domesday-book made by William the Conqueror referred to the time of Edward the Confessor, as that of King Alfred did to the time of Ethelred. As the fourth book of Domesday had many pictures and gilt letters in the beginning, relating to the time of King Edward the Confessor, this led some into an opinion altogether erroneous, namely, that Domesday-book was composed in the reign of King Edward.

DOMESTIC, any man who acts under another, and serves to compose part of his family. Sometimes the term domestics is applied to the wife and children, but most frequently to servants, such as footmen, lacqueys, porters, and the like.

DOMESTIC, *adj.* is sometimes opposed to foreign. Thus "*domestic occurrences*" signify those events which happen in our own country, in contradistinction to those of which we receive intelligence from abroad.

In its more usual acceptation, the term implies something peculiar to *home* or *household*. Thus we speak of *domestic* happiness or pleasures, meaning the pleasures enjoyed in the bosom of one's family; in opposition to those which are found in the bustle of public life, or delusively sought for in the haunts of dissipation.

The solace of domestic enjoyment has been coveted by the wisest and greatest of men. Senators and heroes have shut out the acclamations of an applauding world, in order to enjoy the society of their little ones, and to partake the endearments of family conversation. They knew that even their best friends, in the common intercourse of life, were in some degree actuated by interested motives in displaying their affection; that many of their followers applauded them in hopes of reward; and that the giddy multitude, however zealous, were not always judicious in their appro-

bation. But the attentions paid them at their fire-side, and the smiles which exhilarated their own table, were the genuine result of undissembled love.

"The nursery has often alleviated the fatigues of the bar and the senate-house," says an excellent essayist, (Knox). "Nothing contributes more to raise the gently pleasing emotions than the view of infant innocence enjoying the raptures of a game at play. All the sentiments of uncontrolled nature display themselves to the view, and furnish matter for agreeable reflection to the mind of the philosophical observer. To partake with children in their little pleasures is by no means unmanly. It is one of the purest sources of mirth. It has an influence in amending the heart, which necessarily takes a tincture from the company that surrounds us. Innocence as well as guilt is communicated and increased by the contagion of example. And the great Author of evangelical philosophy has taught us to emulate the simplicity of the infantine age. He seems indeed himself to have been delighted with young children, and found in them what he in vain sought among those who judged themselves their superiors, unpolluted purity of heart.

"Among the great variety of pictures which the vivid imagination of Homer has displayed throughout the Iliad, there is not one more pleasing than the family-piece which represents the parting interview between Hector and Andromache. It deeply interests the heart, while it delights the imagination. The hero ceases to be terrible, that he may become amiable. We admire him while he stands completely armed in the field of battle; but we love him more while he is taking off his helmet, that he may not frighten his little boy with its nodding plumes. We are refreshed with the tender scene of domestic love, while all around breathes rage and discord. We are pleased to see the arm, which is shortly to deal death and destruction among an host of foes, employed in caressing an infant son with the embraces of paternal love. A professed critic would attribute the pleasing effect entirely to contrast; but the heart has declared, previously to the inquiries of criticism, that it is chiefly derived from the satisfaction which we naturally take in beholding great characters engaged in tender and amiable employments.

"But after all that is said of the purity and the solidity of domestic pleasures, they unfortunately appear to a great part of mankind insipid, unmanly, and capable of satisfying none but the weak, the spiritless, the inexperienced, and the effeminate. The pretenders to wit and modern philosophy are often found to renounce the received opinions of prudential conduct, and, while they affect a superior liberality, to regulate their lives by the most selfish principles. Whatever appears to have little tendency to promote personal pleasure and advantage, they leave to be performed by those simple individuals who are dull enough, as they say, to pursue the journey of life by the straight road of common sense. It is true, they will allow that the world must be replenished by a perpetual succession; and it is no less true, that an offspring once introduced into the world requires all the care of painful attention. But let the task be reserved for meaner spirits. If the passions can be gratified without the painful consequences of supporting a family, they eagerly seize the indulgence; but the toil of education they leave to those whom they deem fools enough to take a pleasure in it. There will always be a sufficient number, say they, whose folly will lead them, for the sake of a silly passion called virtuous love, to engage in a life of perpetual anxiety. The fool's paradise, they add with derision, will never be deserted.

"Presumptuous as are all such pretenders to newly-invented systems of life and conduct, it is not to be sup-

Domestic. posed they will think themselves superior to Cicero. Yet Cicero, with all his liberality of mind, felt the tenderness of conjugal and parental attachment, and acknowledged that at one time he received no satisfaction in any company but that of his wife, his little daughter, and, to use his own epithet, his *honied* young Cicero. The great Sir Thomas More, whom nobody will suspect of narrowness of mind, who, by a very singular treatise, evinced that he was capable of thinking and of choosing for himself, has left it on record that he devoted a great share of his time, from the united motives of duty and delight, to the amusement of his children.

"It will be objected by those who pretend to have formed their ideas of life from actual observation, that domestic happiness, however pleasing in description, like many a poetic dream, is but an alluring picture, designed by a good heart, and painted in glowing colours by a lively fancy. The constant company, they urge, even of those we love, occasions an insipidity. Insipidity grows into disgust. Disgust long continued sours the temper. Peevishness is the natural consequence. The domestic circle becomes the scene of dispute. Mutual antipathy is ingenious in devising mutual torment. Sullen silence or malignant remarks fill up every hour, till the arrival of a stranger causes a temporary restraint, and excites that good humour which ought to be displayed among those whom the bonds of affection and blood have already united.

"Experience, indeed, proves that these remarks are sometimes verified. But that there is much domestic misery is no argument that there is no domestic happiness, or that the evil may not be removed. Natural stupidity, natural ill temper, acquired ill habits, want of education, illiberal manners, and a neglect of the common rules of discretion, will render every species of intercourse disagreeable. When those are united by connubial ties who were separated by natural and inherent diversity, no wonder if that degree of happiness which can only result from a proper union is unknown. In the forced alliance which the poet of *Venusium* mentions, of the serpent with the dove, of the tiger with the lamb, there can be no love. When we expatiate on the happiness of the domestic group, we presuppose that all who compose it are originally assimilated by affection, and are still kept in union by discreet friendship. When this is not the case, the censure must fall on the discordant disposition of the parties, and not on the essential nature of family intercourse.

"To form under the direction of prudence, and by the impulse of virtuous love, an early conjugal attachment, is one of the best securities of virtue, as well as the most probable means of happiness. The duties which are powerfully called forth by the relations of husband and father, are of that tender kind which inspires goodness and humanity. He who beholds a woman whom he loves, and a helpless infant looking up to him for support, will not easily be induced to indulge in unbecoming extravagance, or devote himself to indolence. He who has a rising family to introduce into a vicious world, will be cautious of setting a bad example, the contagion of which, when it proceeds from parental authority, must be irresistibly malignant. Thus many who, in their individual and unconnected state, would probably have spent a life not only useless to others, but profligate and careless in

itself, have become valuable members of the community, and have arrived at a degree of moral improvement to which they would not otherwise have attained.

"The contempt in which domestic pleasures have in modern times been held, is a mark of profligacy. It is also a proof of a prevailing ignorance of real enjoyment. It argues a defect in taste and judgment as well as in morals; for the general voice of the experienced has in all ages declared, that the truest happiness is to be found at home."

DOMFRONT, an arrondissement in the department of the Orne, in France. It is 510 square miles in extent, and is divided into seven cantons, which are subdivided into a hundred communes, containing a population of 117,093 persons. The chief place, a city of the same name, is situated on the river Varenne, and contains 358 houses and 2244 inhabitants. Long. 0. 57. W. Lat. 48. 54. N.

DOMICILE, in *Scotch Law*, is the dwelling-place where a person lives with an intention to remain.

DOMIFYING, in *Astrology*, the dividing or distributing the heavens into twelve houses, in order to erect a theme, or horoscope, by means of six great circles, called *circles of position*.

There are various ways of domifying. That of Regiomontanus, which is the most common, makes the circles of position pass through the intersections of the meridian and the horizon; but others make them pass through the poles of the zodiac.

DOMINANT (from the Latin word *dominari*, to rule or govern), among musicians, is used either as an adjective or substantive; but these different acceptations are far from being indiscriminate. In both senses it is explained by Rousseau. The *dominant* or sensible chord is that which is practised upon the dominant of the tone, and which introduces a perfect cadence. Every perfect major chord becomes a *dominant* chord as soon as the seventh minor is added to it.

DOMINANT (*substantive*). Of the three notes essential to the tone, it is that which is a fifth from the tonic. The tonic and the *dominant* fix the tone, in which they are each of them the fundamental sound of a particular chord; whereas the mediant, which constitutes the mode, has no chord peculiar to itself, and only makes a part of the chord of the tonic.

Rameau gives the general name of *dominant* to every note which carries a chord of the seventh, and distinguishes that which carries the sensible chord by the name of a *tonic dominant*; but on account of the length of the word, this addition to the name has not been adopted by musicians, who continue simply to call that note a *dominant* which is a fifth from the tonic; and they do not call the other notes which carry a fifth of the seventh *dominants*, but *fundamentals*, which is sufficient to render their meaning plain, and to prevent confusion.

A *dominant*, in that species of church music which is called *plain-chant*, is that note which is most frequently repeated or beaten, in whatever degree it may be from the tonic. In this species of music there are *dominants* and *tonics*, but no mediant.

DOMINATION, or **DOMINION**, in *Theology*, the fourth order of angels or blessed spirits in the celestial hierarchy, reckoning from the seraphim.

Domfront
||
Domination.

ST DOMINGO.

St Do-
mingo.

ST DOMINGO, or HISPANIOLA, one of the largest and most fertile of the West India islands, extending in length from east to west about 390 miles, and in breadth from 60 to 150 miles, is situated between 17. 37. and 20. 0. north latitude, and between 67. 35. and 74. 15. west longitude. It is called Hayti or the Highland country by the natives, from the mountains with which it abounds, especially in the northern part. The country was formerly divided between the Spaniards, who were the original occupiers, and the French. The last, however, having been expelled by the black population, it became an independent state under the appellation of Hayti; which in 1822, when the Spanish government was overthrown, was extended to the whole country, at that time united under one head. The line of demarcation which separated these two divisions commenced on the south side from the Pedernales or Flint River, and extended in a waving direction to the river Massacre on the north side. The country to the west of this line belonged to the French part, whilst that on the east side formed the Spanish part of the island. By far the greatest portion of the country was in the possession of the Spaniards; their division being reckoned 220 miles in length by 120 in breadth, of which, though a considerable part consists of mountains, these are said to be little inferior in fertility to the champaign country, and to be equally capable of cultivation. The French division is of an extremely irregular figure. The land is deeply penetrated by the Gulf of Gonave, and is in some parts 170 miles in length, whilst in others it is not thirty. It is nearly of the same breadth as the Spanish division.

General
description
of the coast.

Great part of the coast of this island is rocky and dangerous, affording but an imperfect shelter to vessels overtaken by storms. Many of the shipping places on the southern shore are nothing more than open bays, which lie exposed to the storms and hurricanes of the autumnal months. The harbour of St Domingo, formerly thought so commodious and secure, has become too shallow to admit vessels of large burden. There are, however, besides roadsteads and several small harbours, the bays of Neyba and Ocoa on this coast. Into the first flows the river Neyba, which receives vessels of thirty tons burden; its stream, before entering the ocean, divides itself into various channels, which annually changing, confound the pilot, and render the navigation difficult. These, if they were collected into one, would afford a deeper and safer channel. Ocoa Bay is a large and convenient watering-place, with several small rivers falling into it. The entrance is two leagues across, and it gradually widens to near six. On the east side of this bay is the safe and capacious port of Caldera. On the south-east coast is the great bay of Samana, which, in point of size and situation, is one of the most important on the island. From Cape Raffael, which forms the southern point of entrance into the bay of Samana, to the opposite side of the island or peninsula of Samana, the distance is eighteen miles, which is closed in by a bulwark of rocks and sands, the entrance only being left clear, with a safe and deep channel between the shore of Samana and several detached islands. This bay is about sixty miles deep, and is surrounded on every side by a fertile country, suited to all the purposes of trade. Within the compass of this bay whole fleets might ride at anchor in perfect security. The river Yuna, after being joined by the Cambu, and meandering through the rich plains of La Vega Real, falls into the bay of Samana after a course of nearly one hundred miles. Bahia Ecossaise or Scotch Bay, which is situated on

the north side of the peninsula of Samana, is a dangerous rocky place. From thence to Puerto Plata the coast extends about sixty miles in a north-west direction, and in this space stands Balsama Bay, which has only fourteen feet depth of water, and is of difficult navigation. The harbour of Puerto Plata was first discovered by Columbus; the entrance is narrow but safe, and the neighbourhood is rich in every species of woods. There are several other small harbours and bays on this side of the island; but the coast is in general rocky and dangerous.

A country of such magnitude as St Domingo, containing Soil and mountains of great height, with valleys of corresponding surface. extent, necessarily comprises great variety of soil. In general, however, it is fertile in the highest degree, being everywhere watered by copious streams, and yielding in abundance every species of vegetable produce which can minister either to the luxury or comfort of man. The soil consists principally of a rich clay, sometimes mixed with gravel, lying on a substratum of rock. That part of the island formerly occupied by the French is mountainous, but fertile and well wooded, and containing mines both of silver and iron. The Spanish part of the island is mountainous in many parts; whilst in other parts the country is spread out into extensive plains. These are generally in a state of nature, covered with herbage, or with woods of immense growth and the most luxuriant foliage. The mountains intersect the island in two principal chains from east to west. From these, secondary and partial ridges diverge irregularly in different directions, forming beautiful and fertile valleys watered by numerous streams. The highest mountains of the interior, particularly those of Cibao, rise to the height of 6000 feet above the level of the sea. To the north of the capital is the valley called Vega Real or Royal Field, which is by far the largest and finest in the island. Westward it extends to the old French line of demarcation, and in this part it is watered by the river Yaque; to the east, where it is watered by the river Yuna for the space of fifty miles, it projects to the head of the bay of Samana, and is watered by numerous smaller streams, which cross it in various directions. This valley may be said to extend in length about eighty leagues, and in breadth from ten to fifteen.

Edwards, in his *Account of the West Indies*, is of opinion that this and several other districts would, under proper management, yield a greater return of sugar and other valuable commodities than all the British colonies in the West Indies. Other plains also of less extent, but of equal fertility and of easy access, are everywhere found interspersed among the mountainous tracts. Westward from St Domingo, along the southern coast, is the valley of the river Banis, extending from Nisao to Ocoa. Here the pasture is good; but the country is not so well watered as in the other parts of the island; an inconvenience which is sensibly felt by the cattle during the dry months. Farther to the westward and to the north other valleys are found; but where the land, as in this island, is everywhere intersected by ranges of mountains, it is impossible, in any general sketch, to describe particularly that continual succession of hill and dale which diversifies the face of the country. Eastward from the capital are those immense plains called Los Llanos, which stretch out to a vast extent on a dead level. They are covered with herbage, and the eye wanders unobstructed over the wide expanse of waving grass, which is occasionally diversified by natural clumps of trees, which seem planted by the hand of man. These plains occupy almost one sixth part of the

St Do-
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St Do-
mingo. island, extending nearly to its eastern coast, being a distance of more than ninety miles, by about thirty wide. They form an immense natural meadow, covered with pasture for vast herds of cattle, which belong to more than a hundred different owners.

Climate. St Domingo is of a hot and moist climate; but the heat is mitigated by the regularity of the sea-breeze, and by the contiguity of the mountains. In the plains the thermometer rises to ninety-six degrees, sometimes to ninety-nine degrees; but in the mountainous tracts it seldom rises above seventy-eight degrees. In the more elevated parts a blanket is not unwelcome during the nights, and in the highest mountains a fire is frequently necessary. In those situations meat may be kept for several days, and in the morning hoar frost is frequent. The seasons, as in tropical countries, are divided into the wet and the dry. The rains are periodical, and are heaviest in May and June, when the rivers, which at other times scarcely supply water for a continued stream, overflow their banks, and, with an impetuous torrent, sweep over the neighbouring plains. The climate of St Domingo is unhealthy to Europeans, owing to these violent heats and heavy rains; and hence all metals, however bright their original polish, soon contract a tarnished appearance. This is more observable on the sea-coast, which is also more unhealthy than the interior parts of the island. Hurricanes are not frequent, but in the southern parts of the island violent gales of wind, generally preceded by a closeness and sultriness in the atmosphere, frequently occur. These, however, are not attended with such fatal effects as the hurricanes in the Windward Islands.

Rivers. The island of St Domingo abounds in rivers and smaller streams, which flow from the mountains in the interior, in different directions, to the sea. Of these, the principal are the Haina, the Nigua, the Nizao, the Ozama, the Neyba, the Ocoa, the Yane, and the St Yago or river of Monte Christi. Near the south part of the French line of demarcation is the beautiful lake of Henriquillo, which is about eighteen leagues in circumference; and though it is about eight leagues from the sea, its water is perfectly salt, and of the same specific gravity as that of the ocean. The same fishes are also found in it, such as the shark, seal, porpoise, &c.

Vegetable
produc-
tions. The fertile soil of St Domingo is distinguished by the variety of its vegetable productions, many of which are rare and valuable. The mahogany tree grows to a great size, and is of very fine quality. The manchineel tree affords a beautiful species of wood, richly veined like marble, and susceptible of the finest polish. Several species of dye-woods are produced in the forests, though none of them have been tried except fustic. There is a tree called the jagua, the fruit of which is accounted a delicacy by the natives; and of which the juice, as clear as water, makes a stain on linen which is indelible. Different kinds of lignum vitæ are found, as also of several other woods with the same properties, which grow unnoticed and nameless in those unexplored forests. The quiebra hacha or iron-wood, remarkable for hardness, as its name implies, is abundant; and the oak also, which differs in appearance from the European oak, frequently furnishes beams of from sixty to seventy feet in length. On the north side of the island are extensive forests of pine, which is much used for the purposes of ship-building; and Brazil-wood is found in many parts of the coast. The satin-wood of this island is heavier than that of the East Indies, and it takes so fine a polish that it does not require to be varnished. The cotton tree is the largest of all the vegetable productions, and is formed into the lightest and most capacious canoes. Every variety of the palm tree is found in the woods, of which they form a principal ornament. The palmetto or

mountain cabbage is an erect and equal tree, which grows to the height of seventy feet, with cabbage at the top. In the congenial soil of this fertile island the sugar-cane, cotton and coffee plants, grow in the greatest luxuriance. There is also the calabash, the fruit of which serves as a substitute for earthen-ware; the plantain, the staff of life in the West Indies; vanilla, which is found indigenous in the unfrequented woods; quassia; simarouba, which is a tall and stately plant, waving gracefully in the wind; sarsaparilla, indigo, tobacco, turmeric, ginger, and rice plants. The fruits and nutritive roots of St Domingo are nearly the same as those of Jamaica; but they are more abundant, and extremely fine. Of these may be enumerated the choux caraib or Indian kale, with a variety of other vegetables that come under the same denomination; the avocado or vegetable mallow, the melon, sapadillo, guava, pine-apple, bread and jack fruit, mango, nuts, rose-apple, plums, &c. of many different species. Flowers in endless variety and splendour adorn the wild scenery of the woods, and exhale their fragrance in the desert air.

In addition to all its other valuable productions, this Mines. island formerly contained considerable mines of gold, silver, copper, and iron. But the mines of the two former metals have, according to that strange and perverted policy by which Spain has uniformly sought to depress her colonies, been long closed against the industry of the inhabitants, and a military force was even posted at the different mining stations, to prevent those hidden gifts of nature from being brought to light, and converted into active and productive capital, for the improvement of commerce and the benefit of the world at large. St Domingo also produces jasper, porphyry, agates, antimony, of which there is a mine yielding pieces of six and eight pounds; mineral copperas, red ochre in globules as large as a pigeon's egg, amethysts of a transparent violet colour and of an excellent water, and in the Neyba and Hinchu rivers pebbles have been found containing brilliants.

The indigenous quadrupeds of this island were confin- Animals. ed to four species, which the Indians called Hutia, Quemi, Mohuy, and Cory. Of these, all are extinct except the first. St Domingo, however, has procured, by its intercourse with Europe, a new stock of animals, of far more importance than the diminutive species which it has lost. These consist particularly of horned cattle, hogs, sheep, goats, horses, mules, and asses, which have multiplied prodigiously in the wild and extensive pastures of the interior. Wild fowl are abundant, consisting of various species of ducks, wild pigeons, the flamingo, the wild peacock, the nightingale or mocking bird, the banana bird, the Guinea fowl, the ortolan, and parrots of various species. The rivers abound with fish, some of which are very delicate. Turtle of all kinds are taken, and the land-crab is much esteemed. The serpents are not dreaded; but the centipedes, which are frequent in old buildings, are large and dangerous. The scorpion is rarely seen; but the venomous crab-spider, which is equally dangerous, is sometimes met with.

The island of St Domingo was, as already mentioned, Popula- divided between the Spaniards and the French; the latter tion. possessing about a fourth part of it, and the remaining three fourths belonging to the Spaniards. According to the general and best authenticated estimate, the population of the French portion of St Domingo amounted in 1789 to,

Whites..... 30,826

Free people of colour..... 27,548

Slaves..... 465,429

But other statements add about 10,000 or 11,000 to this estimate.

In 1785 the population of the Spanish side of the island amounted to,

St Do-
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mingo.

Free people of all colours.....	122,640
Slaves	30,000
	152,640

During the troubles which ensued, no records are to be found, on the truth of which we can rely. But it is certain that the population must have been greatly reduced by emigration and death; many proprietors having emigrated with their slaves both to the American continent and to the neighbouring islands, and great destruction of life having taken place in the bloody transactions which occurred between 1791 and 1820. Humboldt has estimated, though he does not tell on what data, the entire population at 375,000 in 1802; and after the death of Dessalines it has been supposed, though still on uncertain data, to amount to 400,000. Since this period it has greatly increased; and Mr Placide Justin, on information received since April 1825, considers the whole population as amounting to 700,000, whilst by Humboldt it is reckoned at 800,000. Mr Mackenzie, who was appointed in 1826 consul-general in Hayti by the British government, obtained a population return, which was officially made out and laid before the legislative body, in order to apportion the contribution for the purpose of liquidating the French indemnity. According to this official account, in the accuracy of which there is every reason to confide, the population of the French part of St Domingo amounted to 351,716, and that of the Spanish division to 71,223, making together 422,939.

History.

This island was discovered by Columbus in 1492, and was soon filled with adventurers, who crowded from Europe to the new world in search of sudden wealth. The natives were reduced to slavery by these settlers, who spread themselves over the island, and by their industry the colony increased rapidly in wealth and prosperity. But as it was chiefly by the desire of gold that settlers were attracted to this distant shore, St Domingo was in its turn abandoned for other countries of greater reputed wealth; and the country gradually declined, and, instead of yielding a revenue, became a burden on the mother country. About the middle of the sixteenth century the island of St Christophers was taken possession of by a mixed colony of French and English, who being attacked by the Spaniards, were forced to fly to the barren isle of Tortuga, where they established themselves, and grew formidable, under the well-known appellation of buccaneers. They at last obtained a firm footing in St Domingo, into which they had made only predatory incursions; and by the treaty of Ryswick that part of the island of which they had obtained possession was ceded to the king of France, who acknowledged these adventurous colonists as his subjects. The French colony languished for a while under the galling restrictions imposed on its trade by the mother country; but these being removed about the year 1722, it attained to the highest pitch of prosperity; and such was its flourishing state when the French revolution commenced in 1789. In St Domingo, as in all the European colonies, the population is composed of three classes, namely, the whites, the people of colour, and the blacks. Of these the whites were the favoured class, who engrossed all public honours and emoluments, and in whose hands all power centred, both civil and military. They considered the people of colour as a degraded caste, with whom it was disgraceful to associate on terms of equality. The black slaves ranked lowest in the scale, and they experienced from both classes all the evils of the most cruel bondage. A society framed of such hostile elements contained in its very constitution the seeds of hatred and contention; and in the course of the revolution which occurred in the mother country these were brought into full activi-

ty. The important discussions by which France was at that time agitated kindled a corresponding sensation in the colonies; and the hostile races of the whites and mulattoes were already violently inflamed against each other by the eagerness of their contests, when the national convention, in 1791, passed the memorable decree, giving to the people of colour the unlimited enjoyment of all the rights which were possessed by French citizens; thus at once breaking down all the distinctions which had prevailed in the colony, and which were sanctioned by custom and inveterate prejudice. This decree was received as might have been expected. It excited loud and general disapprobation amongst the whites, who immediately adopted the most violent measures. The national cockade, the badge of their attachment to the revolution and to the mother country, was openly trampled under foot, and the authority of the governor-general and the supremacy of the mother country were equally set at nought. The several parishes proceeded to the election of a new assembly, which accordingly met on the 9th of August, under the title of the general assembly of the French part of St Domingo. The mulattoes in the mean time, alarmed at these proceedings, were collecting in armed bodies for their defence; and the whites were so intent on the meeting of the new colonial assembly that they offered no opposition to these assemblages.

Such was the state of affairs between the two hostile First classes of the whites and the mulattoes, when a new and movements more powerful party, whom all united to oppress, now sud- of the ne- denly combined for their own protection and for the de-groes. struction of their enemies. On the 23d of August reports reached the town of the Cape that the negro slaves in the neighbouring parishes were in arms, and that they were destroying the plantations and massacring the inhabitants. This terrible intelligence was confirmed next day in its full extent by crowds of wretched fugitives from the neighbouring country, who, having abandoned their property, were flying to Cape Town from the fury of their savage enemies. The success of this bold and deep-laid conspiracy spread universal consternation amongst the white inhabitants. The citizens in Cape Town were immediately summoned to arms. The women and children were at the same time sent on board the ships in the harbour; the domestic negroes in the town were placed under a strong guard; and the free mulattoes, protected from the hatred of the whites by the timely interposition of the governor and colonial assembly, were enrolled in the militia, their wives and children being left as hostages for their fidelity. Other measures were also adopted to secure the place against any sudden attack of the infuriated slaves. When these precautions had been adopted, several small detachments of troops were sent out to act offensively against the insurgents; but although partial successes were obtained in these encounters, the general result too fatally demonstrated to the white inhabitants their own weakness and the strength of their enemies, whose fearful superiority of numbers, it was evident, would finally decide the contest in their favour. In this destructive war it was calculated that, about two months after its commencement, upwards of 2000 white inhabitants were massacred; that 180 sugar plantations, and about 900 coffee, indigo, and cotton settlements were destroyed, and a thousand families reduced from opulence to misery. Of the insurgents about 10,000 are supposed to have perished in the field, and some hundreds by the hands of the public executioner; and the rebellion, which had been hitherto confined to the northern parts of the island, now began to spread through the western districts, where the blacks were aided by the people of colour, and where, under their united devastations, the country was laid waste for an extent of more than thirty miles.

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At length they approached the town of Port-au-Prince with the intention of setting it on fire; and it was with great difficulty that a treaty was concluded by which the place was saved from destruction. This treaty was ratified by the colonial assembly, which also announced its intention of granting an extension of privileges to the free people of colour. But in the mean time the national assembly at home, under an impression of the ruinous consequences of their rash concessions to the people of colour, had voted a repeal of the law which gave them the same privileges as the whites; and the intelligence of this repeal reached the colonies at the time when the colonial assembly was holding out the expectation of general equality and freedom. The mulattoes, therefore, when they heard that the national assembly had repealed their former conciliating act in their favour, imagining that the offer of the whites was an act of concerted treachery to deceive them into a false security, knew no bounds to their indignation. All thoughts of peace were now abandoned; and the general sentiment was that the contest could only be terminated by the final extermination of one or other of the hostile parties. The war assumed a diabolical character of cruelty, each studying to outdo the other in acts of revenge. On both sides all prisoners were either massacred without mercy, or reserved for the more solemn barbarity of a public execution.

The national assembly at home, alarmed by the intelligence of these disorders, sent out three civil commissioners, with full powers to settle all disputes. But their authority soon fell into disrepute. Other commissioners were sent, and along with them 8000 troops. Unlike their predecessors, however, they adopted the most arbitrary measures; and about the beginning of the year 1793 they became absolute masters of the colony. But their severities at last provoked resistance to their authority; and having displaced the governor Galbaud, an officer of artillery, and ordered him to France, he, along with his brother, collected about 1200 seamen, with whom they landed, and being joined by other volunteers, attacked the government house, where the commissioners were posted with their force. A fierce and bloody conflict now took place, which terminated without any decisive advantage on either side, and next day the fighting was continued in the streets of the town with various success. In the beginning of these disorders, the commissioners had sought to strengthen their party by the aid of the revolted blacks; and a body of these auxiliaries, amounting to 3000, now entered the place, which immediately became a horrid and revolting scene of conflagration and slaughter. Men, women, and children, were massacred by these barbarians without distinction. The white inhabitants, flying to the sea for protection, were met by a body of armed mulattoes, by whom they were put to the sword without mercy; the half of the town was consumed by the flames; and the commissioners, themselves affrighted at these disorders, escaped to the sea-shore, whence, under cover of a ship of the line, they viewed with dismay the wide-spreading mischief.

Ever since the commencement of these unhappy disorders, the white inhabitants had emigrated in great numbers to the neighbouring islands, and to the United States of America; and some of the principal inhabitants having repaired to Britain, induced the British government, by their representations, to prepare an armament with a body of troops to co-operate with such of the inhabitants as were desirous of placing themselves under its protection. At this period, according to the accurate information of Edwards, the military force of St Domingo consisted of from 14,000 to 15,000 effective troops, and 25,000 free negroes, mulattoes, and slaves. About 100,000 blacks

had retired to the mountains to enjoy a savage independence, and in the northern districts 40,000 slaves still continued in arms. It was in these circumstances that the island was taken possession of in September 1793 by a British force. But though the expedition gained some partial advantages, the climate soon began to make the most dreadful havock amongst the troops, and prevented them from achieving any solid success. Toussaint l'Ouverture, who was appointed general in chief of the black armies of St Domingo in 1797, proved himself an able and an indefatigable enemy; and at length the British were obliged to evacuate the country in the year 1798. On the 1st of July 1801 the independence of St Domingo was formally proclaimed.

But the war in Europe between Great Britain and France being by this time concluded by the peace of Amiens, Bonaparte, now chief consul of France, sent out an armament consisting of twenty-six ships of the line, and 25,000 troops, under the command of General Leclerc, his brother-in-law, for the purpose of reducing the revolted colony of St Domingo. To enter into the details of the barbarous and bloody war now begun against the unfortunate inhabitants of St Domingo would not be consistent with our limits, nor would such a narrative, we are persuaded, be interesting to our readers. It will be sufficient to observe, that the numbers and discipline of the force now landed, joined to the skill of its leaders, overpowered all open resistance in the field; so that the blacks, after several obstinate conflicts, and after burning some of the principal towns, were finally compelled to retire into the inaccessible mountains of the interior, whence they carried on, under their undaunted leader Toussaint, a desultory war against detached parties of their enemies. Elated by this success, Leclerc now threw off the mask, and rashly issued an edict proclaiming the former slavery of the blacks. Toussaint was not slow to profit by this error. Having effected a junction with Christophe, who had still 300 troops under him, and being joined by the cultivators in great numbers, who were no longer deaf to his call, he poured with this collected host like a torrent over the plain; and having everywhere forced the French posts, and driven before him their detached corps, he surrounded the town, to relieve which the French general was compelled to hasten to the spot by forced marches with all the troops he could collect. Here he had recourse to his former arts, and he was but too successful in cajoling the negro chiefs, wearied of war, into a suspension of arms. Having watched his opportunity, he privately seized on Toussaint with his family, and embarked him on board of a frigate for France, where, being thrown into prison, he expired in April 1803. This act of cruel treachery spread universal alarm among the black chiefs; and Dessalines, Christophe, and Clerveaux soon appeared at the head of considerable bodies of black troops. This last contest for the possession of St Domingo was distinguished by a degree of barbarity which surpasses belief. The whites and the blacks seemed to vie with each other in deeds of cruelty and revenge. Retaliation was the plea still used to sanction every enormity, under which an arrear of vengeance was at length accumulated on both sides, which nothing short of the utter extermination of one of the parties could thoroughly satisfy. The French, however, it was clear, were now gradually losing ground. About the year 1803 they were confined within their fortifications by the vigorous movements of the black armies; and though reinforcements were received from France, the French general was forced to enter into a capitulation with Dessalines, by which he agreed in 1803 to evacuate the whole island. On the 30th November of that year, the standard of the blacks was hoisted in Cape François; and the French troops, amounting to 8000,

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surrendered themselves prisoners of war to the British squadron, by which they were closely watched. In 1804 a formal declaration of independence was issued, to which were attached all the names of the generals and chiefs. The ancient aboriginal name of Hayti was revived; while Dessalines, whose military talents were in great esteem, was elected governor-general for life; and in October 1804 he was crowned emperor with great pomp. In this situation he began to display all the cruelties of a tyrant, massacring without mercy the white inhabitants, and committing the most barbarous depredations. A conspiracy was in consequence formed against him; and as he was advancing against the insurgents at the head of a few troops, he fell into an ambuscade where he was expecting his own advanced guard, and fell pierced with balls. His power was disputed by various chiefs, of whom those best known and most successful were Petion and Christophe, the former ruling over the north of the island, the latter over the southern districts. Each having a powerful body of adherents, a civil war was the immediate consequence of their rival claims. In this war, which continued for several years, many battles were fought and many lives were lost; but the issue of the struggle was still doubtful, when in the year 1810 a suspension of hostilities took place, though no formal treaty was signed. From this period civil war ceased in the island of St Domingo. Christophe was declared king of Hayti under the title of Henry I.; and, in imitation of other monarchs, he created various orders of nobility, together with numerous officers of state. He assumed to himself absolute power, and committed the greatest cruelties, according to the mere caprice of his own arbitrary will. His tyranny produced general discontent, and at last an insurrection against him. Being deserted by his troops, he anticipated with his own hand the fate which awaited him. On the 20th of October 1820 he retired to his chamber, where he discharged two pistols, one through his head and the other through his heart, and instantly fell dead, before any alarm could be given. Petion died in March 1818, after having presided over the republic upwards of eleven years. He was succeeded by General Boyer, who ruled over the northern division of the island until the year 1820; when taking advantage of the death of Christophe, and the confusion occasioned by that event, he pressed forward with a considerable force, and took possession of every strong place in the kingdom; and in this manner the whole French division of St Domingo was for the first time united under one ruler. The Spanish division of the island had been ceded to France in 1795 by the treaty of Basle, but it was restored to Spain by the peace of 1814. The feeble government of the mother country, however, was no longer able to control the revolutionary spirit which prevailed in the colony; and in November 1821 the Spanish governor was arrested by the insurgent party, headed by a lawyer of the name of Nunez, and a declaration of independence immediately issued. A strong party afterwards appeared in favour of a union of the whole island under one chief. On the 21st of January 1822 the Haytian flag was first displayed in the city of St Domingo; and on the 9th the keys of the city, and with them the dominion of the whole island, were surrendered to President Boyer. The independence of the new state was recognised by the mother country in 1825, on condition that its ports should be open to the ships of all nations; that French vessels should pay only half duties; and that 150,000,000 of francs should be paid as an indemnity, in five equal payments, the first on the 31st December 1825. Thus, after a series of struggles, beyond all example bloody and ferocious, the whole island of Hispaniola, with its adjacent islets, is now subject to one government, under the title of the Republic of Hayti.

An independent nation of revolted slaves is a novelty in the political world; and its constitution, laws, policy, and trade, form an interesting subject of inquiry. The original constitution of 1806, which was devised for this state, was founded on the model of the American democracy, but was in all respects very ill adapted to the emancipated blacks of St Domingo. The report of the constituent assembly, on which it is founded, is a mere exposition of abstract principles inapplicable to the condition of the community for whose use it was designed; and accordingly this constitution, framed upon the American model, is in practice an absolute elective monarchy, under the forms of a republic. The president-general, Jean Pierre Boyer, holds his office for life, and has the right of appointing his successor. There are two legislative bodies, the senate and house of representatives, who have the power of making laws, of approving or rejecting all treaties, and of negating the president's choice of a successor. But the whole efficient authority is nevertheless wielded by the first magistrate, who has the entire patronage of the state, civil as well as military; and who has the means of controlling the legislative bodies, and rendering them subservient to his will. He proposes to the commons all the laws except those connected with taxes; he is charged with the duties of the executive, maintaining foreign and domestic peace, and declaring war, subject, however, to the approbation of the senate. He can also issue proclamations in conformity to the laws, and to these he can compel obedience; and he has the command of the armed force. In the case of every vacancy in the senate, he supplies three names, from which a new candidate must be chosen; so that the senate are in some measure his nominees. He has besides the appointment of every public functionary, and the power to dismiss them; the practice of the constitution thus varies entirely from its theory, being little else than a rude military despotism. How far the actual condition of the Haytians under their present ruler is comfortable or otherwise, whether the laws are duly administered for the protection of civil rights, and how far a liberal spirit actuates the government on these and other topics, we are not very fully informed. It is certain that the education of the people is an object of public solicitude. But though seminaries for this purpose have been established by the government, no zeal for instruction has been evinced by the people; and hence the progress of improvement has hitherto been slow. The Catholic still continues the religion of the state, though the various revolutions which have taken place have impaired the wealth and influence of the priests. The most perfect toleration is established; and public offices, whether civil or military, are open to all, whatever may be their religious creed. Besides the higher courts, which have a supreme jurisdiction, there are eight local tribunals for the trial of civil and criminal cases; and in these trial by jury has lately been introduced. From the peculiar origin and character of the Hayti community, idleness, of which the law of other countries takes no cognisance, is here punishable by imprisonment and by flogging; and every successive government has found it necessary to apply this stimulus to the languishing industry of the revolted negroes. The last law on the subject is the *code rural*, which declares that all persons must cultivate the earth, directs the mode of managing landed property, of regulating the rural police, of repressing vagrancy by converting reputed vagabonds, who may be condemned to labour on the public works, or sent to prison until they make a contract to labour for individuals.

But notwithstanding those severe laws, this fertile island, according to Mr Mackenzie, has not yet become the seat of industry and of commerce. It has never recovered from

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the fearful devastations to which it was exposed in the long course of the wars and bloody dissensions which followed the emancipation of the slaves. It was formerly distinguished above all the other West India islands for its beauty and fertility, and for its fine cultivation, and abundant produce of sugar, its great staple. Its sugar-works, and the magnificent aqueducts for the irrigation of its fertile plains, are now destroyed, and scarcely any sugar is produced for exportation. We learn, from the well-informed author of the *Notes on Hayti*,¹ that in 1789, the exportation of clayed sugar from St Domingo amounted to 47,500,000 French pounds; under Toussaint's government it had diminished to 16,500 pounds; and in 1818 to 190 pounds. The exportation of raw sugar in 1789 exceeded 93,500,000 French pounds; in 1801 it had fallen off to 18,500,000 pounds; and it progressively declined, till, in 1825 and 1826, it again advanced to nearly 33,000 pounds. The produce and exportation of coffee has declined in a similar proportion. In 1789 the export of this article amounted to 76,835,219 pounds, in 1801 it had declined to 43,420,270 pounds; and in 1825 and 1826 it amounted only to about 30,000,000 of pounds. Cacao was never exported in great quantities by the French colonists; nor was any great attention paid to the cultivation of indigo, of which the export amounted in 1789 to 750,000 pounds. It has now altogether ceased. Molasses or syrup was never exported in any great quantity, owing to the greater perfection of the colonists in the art of making sugar. With the decline of this more valuable cultivation, its export has increased from 25,749 pounds, its amount in 1789, to 211,927 pounds in 1822. The growth of tobacco has been greatly extended; and cigars are manufactured in great quantities, both for home and foreign use. The French exported no dye-woods, such as logwood, fustic, and lignum-vitæ. But the indolent natives of St Domingo, declining the more laborious process of sugar-cultivation, for which they have neither industry nor capital, have greatly enlarged this branch of trade, having in 1801 exported of dye-woods 6,768,634 pounds. This trade still continues to flourish, about five or six millions of pounds of the commodity being annually exported. For a like reason the exportation of mahogany has increased from about 5000 cubic feet, its amount prior to the year 1800, to 2,000,000, and in some years to 3,000,000 of feet; another fact, which, according to Mr Mackenzie, proves the decline of systematic regular industry, "and of the advance of whatever, though chiefly done by nature, may be finished at uncertain periods by man." Such is the account given by Mr Mackenzie. But it is proper to add, that there are other and different accounts from respectable eye-witnesses, who

state, that the negroes are industrious of themselves, that agriculture is in a rapidly improving state, and that the products and wealth of the island are annually increasing.

The principal imports are, from Great Britain printed cottons and muslins of all kinds, cotton cambrics, handkerchiefs, checks, dimities, stockings, quiltings, gingham, Irish and brown linens, osnaburgs, cotton and coffee bagging, woollen cloths, ironmongery, tin ware, Staffordshire ware, glass, cutlery, and paints. France supplies wines, cheese, taffetas, beer, liqueurs, brandy, oil, silk shawls, silk stockings, satins, linens, boots and shoes, toys, ribbons, parasols, gloves, cambrics, Indiennes, saddlery, hardware, military accoutrements and decorations, perfumery, confectionary, preserved fruits, &c. From Holland the importations are small, and consist of linens of different qualities, chiefly German, cotton and coffee bagging, Russia duck, linen checks, inferior woollens, German wines, provisions, and hardware. The small shipments from Germany consist of the same articles; and from the United States are received chiefly lumber, provisions, candles, mostly spermaceti, soap, tar, pitch, rosin, turpentine and other naval stores, gunpowder, anchors, cordage, copper, oils, nails, pig and sheet lead and shot, leather, India silks, Madras handkerchiefs, besides other lesser articles.

The commerce of the country is oppressed by burdensome restrictions and by heavy duties. All foreign merchants are obliged to take out, at an expense of from 1600 to 2000 dollars, a patent to allow them to carry on a wholesale business at any of the ports, not with each other, but only with the inhabitants. Heavy taxes have also been imposed to pay the French indemnity given to procure the acknowledgment of independence. All foreign merchandise is subjected to a duty of twelve per cent., but French ships are only liable to half-duties. Certain enumerated articles, such as arms, ammunition, and warlike stores, gold, silver, &c. are admitted duty free.

The military force of the kingdom of Hayti consists of Military thirty-three regiments of the line, amounting to 28,600 force. men. Of these, according to the accurate account of Mr Mackenzie, there are two regiments of dragoons, amounting to 576 men without the staff, and five regiments of artillery, amounting to 4500 men. There is besides the guard of the president, consisting of three troops of cavalry, amounting to 864 men, and two regiments of infantry, amounting to 600 men. The corps of gens-d'armes consist of forty-eight troops of cavalry, fifty men in each; and there are, moreover, eight companies of police. There is, besides, the national guard, in which every Haytian serves from the age of fifteen to sixty. (F.)

DOMINIC DE GUZMAN, founder of the Dominican order of monks, was born at Calahorra, anciently called Calagora, in Old Castille, in 1170. He preached with great fury against the Albigenses when Pope Innocent III. published a crusade against that unhappy people; and he was appointed inquisitor in Languedoc, where he founded his order, and had influence enough to get it confirmed by the Lateran council in 1215. He died at Bologna in 1221, in the fifty-first year of his age, and was afterwards canonized. The Dominican order has produced many illustrious men.

DOMINICA, one of the Caribbee Islands, in the West Indies, about twenty-nine miles long and sixteen broad, situated between 61 and 62 degrees of west longitude, and

between 15 and 16 of north latitude. It was so called by Columbus, from its being discovered on a Sunday. The value of this island must not be judged of merely by its productions; for its situation enabled the British, in time of war, to intercept the communication between France and her colonies. The soil is light, and adapted for the growth of coffee; the hills, from which several rivers descend, are covered with the finest wood in the West Indies; and several valuable sulphur mines have been discovered in it. Dominica, on account of its importance, has been raised to the rank of a distinct government. The staple commodities are maize, cotton, cocoa, and tobacco. In this island the black and coloured population is to the white nearly as twenty to one.

¹ See *Notes on Hayti*, by Charles Mackenzie, Esq. vol. ii. p. 158.

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DOMINICA, one of the Marquesas Islands called Hiwaoa, Heevaroa, O-heeva-oa, or Ohiwana, by the natives. It is about eighteen miles in length and forty-five in circumference, being full of rugged hills rising in ridges directly from the sea, and separated by deep valleys, which, as well as the sides of the hills, are clothed with wood. It is separated by a channel two miles wide from Tuchuata or St Christina Island.

DOMINICAL LETTER, popularly called *Sunday Letter*, one of the seven letters A B C D E F G, used in almanacks, ephemerides, and the like, to denote the Sundays throughout the year. See CHRONOLOGY. The word is formed from *Dominica* or *Dominicus dies*, the Lord's day, or Sunday. The dominical letters were introduced into the calendar by the primitive Christians instead of the *nundinal* letters in the Roman calendar.

DOMINICAL, in *Ecclesiastical History*. The council of Auxerre, held in 578, decreed that women should communicate with their dominical. Some authors contend that this dominical was a linen cloth, in which they received the species, not being allowed to receive them in the bare hand; whilst others think it a kind of veil where-with they covered the head. The most probable account is, that it was a sort of linen cloth or handkerchief in which they received and preserved the eucharist in times of persecution, to be taken upon occasion at home. That this was the case appears by the practice of the first Christians, and by Tertullian's book *Ad Uxorem*.

DOMINICANS, an order of religious persons, called in some places *Jacobins*, and in others *Predicants* or *Preaching Friars*.

The Dominicans took their name from their founder Dominic de Guzman, a Spanish gentleman of Calahorra, in Old Castille. He was first canon and archdeacon of Osuna; and afterwards, as above stated, preached with great zeal and vehemence against the Albigenses in Languedoc, where he laid the first foundation of his order. It was approved of in 1215 by Innocent III., and confirmed in 1216 by a bull of Honorius III. under the title of St Augustin; to which Dominic added several austere precepts and observances, obliging the brethren to take a vow of absolute poverty, to abandon entirely all their revenues and possessions, and to assume the title of *Preaching Friars*, because public instruction was the main object and end of their institution.

The first convent was founded at Toulouse by the bishop of that place and Simon de Montfort. Two years afterwards another was established at Paris, near the bishop's house; and some time subsequently a third in the rue St Jacques, whence the denomination of *Jacobins*.

Immediately before his death Dominic sent Gilbert de Fresney, with twelve of the brethren, into England, where they founded their first monastery at Oxford in the year 1221, and soon afterwards another at London. In the year 1276 the mayor and aldermen of the city of London gave them two whole streets by the river Thames, where they erected a very commodious convent, whence that place is still called Black-Friars, from the name by which the Dominicans were called in England.

St Dominic at first only took the habit of the regular canons, that is, a black cassock and rochet; but this he quitted in 1219 for that which the order afterwards wore, and which, it is pretended, was shown by the blessed Virgin herself to the beatified Renaud d'Orleans.

This order gradually diffused itself throughout the whole known world. It had forty-five provinces under the general, who resided at Rome; and twelve particular congregations or reforms, governed by twelve vicars general.

Out of this order proceeded three popes, above sixty cardinals, several patriarchs, a hundred and fifty arch-

bishops, and about eight hundred bishops; besides masters of the sacred palace, whose office has been constantly discharged by a religious person of this order ever since the time of St Dominic, who held it under Honorius III. in 1218.

Of all the monastic orders, none enjoyed a higher degree of power and authority than the Dominican friars, whose credit was great, and their influence universal. But the measures which they used in order to maintain and extend their authority were so perfidious and cruel, that towards the beginning of the sixteenth century their influence began to decline. The tragic story of Jetzer, at Bern, in 1509, during which there occurred an uninteresting dispute between them and the Franciscans, relating to the immaculate conception, must ever reflect indelible infamy on this order. An account of it will be found in Burnet's *Travels through France, Italy, Germany, and Switzerland* (p. 31), and also in Mosheim's *Ecclesiastical History* (vol. iii. p. 294, 8vo). They were indeed perpetually employed in stigmatizing with the opprobrious name of heresy numbers of learned and pious men; in encroaching upon the rights and property of others, in order to augment their possessions; and in laying the most iniquitous snares and stratagems for the destruction of their adversaries. They were also the principal counsellors by whose instigation and advice Leo X. determined on the public condemnation of Luther. The papal see never had more active and useful abettors than this order and that of the Jesuits. The dogmas of the Dominicans are usually opposite to those of the Franciscans.

DOMINIS, MARK ANTONY DE, archbishop of Spalatro, in Dalmatia, at the close of the fifteenth and beginning of the sixteenth century, was a man whose fickleness in religion proved his ruin. His preferment, instead of attaching him to the church of Rome, rendered him disaffected to it. Having become acquainted with the English bishop Bedell, whilst chaplain to Sir Henry Wotton, ambassador from James I. at Venice, he communicated to that prelate his books *De Republica Ecclesiastica*, which were afterwards published at London, with Bedell's corrections. He came to England with Bedell, where he was received with great respect, and preached and wrote against the Roman Catholic religion. He is said to have had a principal hand in publishing Father Paul's *History of the Council of Trent*, at London, which was inscribed to James in 1619. But on the promotion of Pope Gregory XIV. who had been his school-fellow and old acquaintance, he was deluded by Gondomar the Spanish ambassador into the hopes of procuring a cardinal's hat, by which he fancied he should prove an instrument of great reformation to the church. Accordingly he returned to Rome in 1622, recanted his errors, and was at first well received; but he afterwards wrote letters to England recanting his recantation, and these being intercepted, he was imprisoned by Pope Urban VIII. and died in 1625. He was also the author of the first philosophical explanation of the rainbow, which before his time was regarded as a prodigy.

DOMINIUM DIRECTUM, in *Feudal Law*, the right which a superior retains in his lands, notwithstanding the feudal grant to his vassal.

DOMINIUM UTILE, in *Feudal Law*, the right which the vassal acquires in the lands by the feudal grant from his superior.

DOMINUS, in ancient times, a title prefixed to a name, usually to denote that the person was either a knight or a clergyman. The title was sometimes also given to a gentleman not dubbed, especially if he were lord of a manor. In Holland the title *dominus* is still retained, to distinguish a minister of the reformed church.

DOMO D'OSSOLO, a province of the kingdom of Sardinia, the northernmost of the whole dominion. Its ex-

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sacks.

tent is 366 square miles, or 234,240 English acres. It contains sixty-nine market towns and villages, but no city, and only 20,750 inhabitants. The chief place, of the same name, is situated on the river Toccia, in a valley where the road over the Simplon ends. It contains 1260 inhabitants.

DOMUS, a town of Hindustan, in the province of Gujerat, situated at the mouth of the Tuptee, fifteen miles south-west from Surat. Long. 72. 53. E. Lat. 21. 5. N.

DON, or TANAI, a river of Russia, which takes its rise from the small lake of St John, near Tula, in the government of Moscow, and passing through part of the province of Voronetz, a small portion of the Ukraina-Slobodskaja, and the whole province of Azof, divides itself near Tscherkask into three streams, and falls in these separate branches into the Sea of Azof. This river has so many windings, is in many parts so shallow, and abounds with such numerous shoals, as to be scarcely navigable, excepting in the spring, upon the melting of the snows; and its mouth is also so choked up with sand that only flat-bottomed vessels, excepting in the same season, can pass into the Sea of Azof. The banks of the Don, and of the rivulets which fall into it, are clothed with large tracts of forest, the timber of which is floated down the stream to St Demetri and Rostof, where the frigates for the Sea of Azof are chiefly constructed. The navigation of the Don, Mr Cox observes, may possibly hereafter be rendered highly valuable, by conveying to the Black Sea the iron of Siberia, the Chinese goods, and the Persian merchandise; which latter commodities, as well as the products of India, formerly found their way into Europe through this same channel.

DON is also the name of a river in Scotland, which is noticed under the article ABERDEEN.

DON Kossacks, land of, a province of Russia in Europe, taking its name from the river anciently called the Tanais, which passes through it, and falls into the Sea of Azof. It extends from 46. 7. to 51. 4. north latitude, and from 37. 15. to 44. 34. east longitude, and contains 79,442 square miles, or 50,842,000 English acres, being nearly equal to England and Scotland. The whole district is a plain, except on the south-east part, where a low range of hills, a continuation of the Caucasian range, extends into the steppes. The soil is dry, consisting for the most part of a sandy clay; but near the rivers it is highly fertile. The grass on the land is not thick, and the herds of cattle require a large space to feed upon. Besides the Don, it has some streams which mostly empty themselves into that river, but in summer they are nearly dry. Agriculture is but little pursued, and the corn raised is barely sufficient for the consumption. The breeding of cattle, especially of horses, is the chief occupation. Even the common Kossacks have from ten to a hundred horses, and many of the richer class from five hundred to a thousand. The fishing on the rivers and lakes is the branch of industry next in importance to the breeding of cattle. By a census taken in 1796, the inhabitants were 366,247: they are known to have increased since, and were estimated in 1827 as amounting to at least 500,000. The feudal system prevails, the land is held by military tenure, and every man is a soldier. The country is divided into seven circles. The chief city

is Tscherkask, situated on an arm of the Don, and said to contain about 15,000 inhabitants.

DONALDSON, WALTER, a learned Scottish writer of the seventeenth century, was a native of Aberdeen, but the period of his birth has not been specified. His father was Alexander Donaldson, who is described as an esquire, his mother was Elizabeth the daughter of David Lamb of Dunkenny.¹ In his youth, as he himself informs us, he attended David Cunningham, bishop of Aberdeen, and Sir Peter Young, during their embassy to the king of Denmark and to some of the princes of Germany. He returned to Scotland, but after a short residence he again visited the continent; and he now prosecuted his studies in the university of Heidelberg, where the civil law was ably taught by the elder Gothofredus. It was perhaps in this university that he took the degree of LL. D.² While he resided at Heidelberg, he appears to have taken private pupils; for he mentions that he there read to some students a synopsis of ethics, which a young man named Werner Becker, a native of Riga, published without his consent or knowledge. This work, which was reprinted in Britain as well as in Germany, bears the title of "*Synopsis Moralis Philosophiæ, III. libris.*" *Ex officina Palæthiorum*, 1604, 8vo. He likewise complains that Keckermann had too unscrupulously availed himself of his labours, and he specifies a curious instance of this plagiarism. Donaldson afterwards settled in France, where he was appointed principal of the College of Sedan, and at the same time discharged the duties of professor of moral and natural philosophy, and of the Greek language; so that his attainments must have been various, and his labours not inconsiderable. In this protestant seminary he was associated with two of his learned countrymen: Andrew Melville was one of the professors of divinity, and John Smith was one of the professors of philosophy.³ His next publication, an arrangement in Greek and Latin of passages extracted from Diogenes Laertius, is entitled "*Synopsis Locorum Communium, in qua Philosophiæ Ortus, Progressus, &c. ex Diogene Laertio digeruntur.*" *Francof.* 1612, 8vo. At Sedan he continued to reside for the space of sixteen years, and was then invited to open a college at Charenton, near Paris; but the attempt was immediately resisted, and it seems to have been ultimately frustrated by the jealousy of the papists. In order to occupy himself during the dependance of the legal process, he prepared for the press another learned work: "*Synopsis Oeconomica, authore G. Donaldsono Scoto-Britanno, Abredonensi, J. C. ad celsissimum Carolum, Walliæ Principem.*" *Paris.* 1620, 8vo. It was reprinted at Rostock, 1624, 8vo. And another edition speedily followed, *Francofurti*, 1625, 8vo. Bayle considered this as a book which deserved to be read.⁴ With respect to the subsequent history of the author, we have not been able to collect any information; but it is not improbable that he resumed his station at Sedan, and there ended his days. Elizabeth Goffin, describing herself as the widow of Donaldson, addressed to Sir John Scot a letter dated at Sedan on the 15th of April 1630.⁵ From this letter it appears that he left several children.

(x.)

¹ *Litera Prosapiæ Alexandri Donaldson, Medicinæ Doctoris*, dated at Edinburgh 15 November 1642. This is the son of Walter Donaldson. MS. Adv. Lib. W. 6. 26. p. 21. According to this account, one of his ancestors was Elizabeth Hay, daughter of George earl of Errol.

² In the attested pedigree already quoted, we find mention made "Walteri Donaldson, Armigeri, Utriusque Juris Doctoris apud Ruppellam in Gallia;" but as Rochelle was not the seat of a university, we cannot but suspect the accuracy of the statement. A college, including a principal and four regents, was established there in the year 1561; but it did not obtain the privileges of a university, and had no law faculty, and no professor of law. (Expilly, *Dictionnaire Géographique, Historique, et Politique des Gaules et de la France*, tom. vi. p. 354.)

³ *M'Crie's Life of Melville*, vol. ii. p. 420.

⁴ Bayle, *Dictionnaire Historique et Critique*, tom. ii. p. 1013.

⁵ *Epistolæ doctorum Virorum ad Jo. Scotum*, N° 227. MS. Adv. Lib. In the pedigree, she is described as the legitimate daughter

Donaria
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Donatists.

DONARIA, among the ancients, in its primary signification, meant the places where the oblations offered to the gods were kept; but it was afterwards used to denote the offerings themselves, and sometimes, though improperly, the temples.

DONATION (*Donatio*), an act or contract by which a man transfers to another either the property or the use of the whole or a part of his effects as a free gift.

DONATISTS, ancient schismatics in Africa, so denominated from their leader Donatus. This sect arose in the year 311, when, in the room of Mensurius, who died in that year on his return to Rome, Cæcilian was elected bishop of Carthage, and consecrated by the African bishops alone, without the concurrence of those of Numidia. The people refused to acknowledge him, and set up in opposition Majorinus, who, accordingly, was ordained by Donatus bishop of Casæ Nigræ. The Donatists were condemned, in a council held at Rome, two years after their separation; again, in another held at Arles the year following; and a third time at Milan in 316, before Constantine the Great, who deprived them of their churches, sent their seditious bishops into banishment, and even punished some of them with death. Their cause was espoused by another Donatus, called the Great, the principal bishop of that sect, who, with numbers of his followers, was exiled by order of Constantine. Many of them were punished with great severity. However, after the accession of Julian to the throne in 362, they were permitted to return, and restored to their former liberty. But Gratian published several edicts against them, and in 377 deprived them of their churches, and prohibited all their assemblies. Yet notwithstanding the severities which they suffered, it appears that towards the close of this century they had a very considerable number of churches; but about the same time they began to decline, on account of a schism among themselves, occasioned by the election of two bishops, in the room of Parmenian, the successor of Donatus; one party elected Primian, and were called *Primianists*, and another Maximian, and were called *Maximianists*. Their decline was also precipitated by the zealous opposition of St Augustin, and by the violent measures which were pursued against them by order of the Emperor Honorius, at the solicitation of two councils held at Carthage, the one in 404, and the other in 411. Many of them were fined, the bishops were banished, and some were put to death. This sect revived and multiplied under the protection of the Vandals, who invaded Africa in 427, and took possession of this province; but it sunk again under new severities, when their empire was overturned in 534. Nevertheless they remained in a separate body till the close of this century, when Gregory, the Roman pontiff, having used various methods for suppressing them, his zeal at length succeeded, and there are few traces to be found of the Donatists after this period. They were distinguished by other appellations, as *Circumcelliones*, *Montenses* or *Mountaineers*, *Campites*, *Rupites*, and so on. They held three councils, or conciliabules, one at Cyrta in Numidia, and two at Carthage.

The errors of the Donatists, besides their schism, consisted in holding that baptism conferred out of the church, that is, out of their sect, was null (for which reason they re-baptized those who joined their party from other churches, and re-ordained their ministers), and that theirs was the only true, pure, and holy church, all the rest of the churches being regarded as prostitute and fallen.

Donatus seems likewise to have inclined to the doctrine of the Arians, with whom he was closely allied; and accordingly St Epiphanius, Theodoret, and some others, accused the Donatists of Arianism; nor is it improbable that the charge was well founded, because they were patronized by the Vandals, who maintained that doctrine. But St Augustin affirms that the Donatists, in this point, kept clear of the errors of their leader.

DONATIVE (*Donativum*), a present made by any person, and called also *gratuity*.

The Romans made large donatives to their soldiers, and hence the soldiers in time became the masters of the Romans. Julia Pia, wife of the Emperor Severus, is called on certain medals *mater castrorum*, because of the care she took of the soldiery, by interposing for the augmentation of their donatives.

Donative was properly a gift made to the soldiery, as *congiarium* was a gift made to the people. Salmasius, in his notes to Lampridius's Life of Heliogabalus, in mentioning a donative which that emperor gave of three pieces of gold per head, observes, that this was the common and legitimate rate of a donative. Casaubon, in his notes on the Life of Pertinax by Capitolinus, observes, that Pertinax made a promise of 3000 denarii to each soldier, or upwards of L.97 sterling. The same author writes, that the legal donative was 20,000 denarii; that it was not customary to give less, especially to the prætorian soldiers; and that the centurions had double, and the tribunes more in proportion.

DONATIVE, in the canon law, a benefice given and collated to a person by the founder or patron, without either presentation, institution, or induction by the ordinary.

DONATO, a town of Italy, in the grand duchy of Parma, at which is a medicinal bath. It contains 2200 inhabitants.

DONATO, a town of Italy, in the province Terra di Lavoro, of the kingdom of Naples, with 2390 inhabitants.

DONATORY, in *Scotch Law*, that person to whom the king bestows his right to any forfeiture which has fallen to the crown.

DONATUS, a schismatic bishop of Carthage, founder of the sect of DONATISTS. His followers honoured him like a god. He died about the year 368.

DONATUS, *Ælius*, a grammarian, who lived at Rome about the middle of the fourth century. He was one of St Jerome's masters, and composed commentaries on Terence and Virgil.

DONAUESCHINGEN, a city of Baden, in the circle of the Lake. The source of the Danube is here in the court of the palace of the Prince of Furstenburg, who is the chief proprietor. The city walls are destroyed. It contains 350 houses, with 2083 inhabitants employed in various handicraft trades.

DONAWERTH, a bailiwick in the circle of Upper Danube, of the kingdom of Bavaria. It extends over seventy-four square miles, or 47,360 English acres, and contains one city and twenty-eight villages, with 8353 inhabitants. It is a fertile district, and yields good corn, tobacco, and fruit. The capital, of the same name, is on the Danube, and contains 503 houses, and 2431 inhabitants, who are employed in manufactures from wool, hemp, and flax.

DONCASTER, a large town in the wapentake of Strathforth and Tickhill, in the county of York, 158 miles from London. It is a well-built town, and occupies a fine situa-

Donative
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Doncaster.

ter "Joannis Goffan de Mostancells prope seden, et Joan. de Hen." For *seden*, we must apparently read *Sedanum*. The entire transcript, which is in the hand-writing of Robert Myln, is far from being accurate. In the preceding line, Donaldson's wife is called Hoffan. Her real name appears to have been Goffin.

Dondra-
head.
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Donegal.

tion on the river Don, which is thus far navigable. It is celebrated for the wealth of its corporation, the races which are annually held here, and for its magnificent church. These attractions have drawn many residents, who subsist on moderate fortunes. The first power-looms were attempted here near forty years ago. There is some trade by the river, and a large market held on Saturday. The inhabitants amounted in 1801 to 5697, in 1811 to 6935, in 1821 to 8544, and in 1831 to 10,801.

DONDRAHEAD, a low point of land which forms the southern extremity of the island of Ceylon, adjacent to which is a populous village, where are still to be seen the remains of a Hindu temple, which bears marks of having once been a magnificent structure, and contiguous to it a smaller one dedicated to Boodha. Long. 80. 40. E. Lat. 5. 50. N.

DONEGAL, the most north-western county in the province of Ulster, in Ireland, is bounded on the north and west by the Atlantic Ocean, on the east by the counties of Londonderry and Tyrone, and on the south by those of Fermanagh and Leitrim, and by the ocean. It contains 1,165,107 acres, or 1820 square miles, of which not more than 520,736 acres are arable, the remainder, amounting to 644,371 acres, being mountain and bog. In shape it somewhat resembles a rhomboidal quadrangle, indented on its maritime sides by numerous deep bays and inlets; its longer diameter, measured in a north-eastern direction from Tellen Head to Malin Head, being eighty-five miles; its shorter, extending in a south-eastern line, from Bloody Farland Point to the town of Lifford, forty-two miles.

According to Ptolemy, the Erdini and Venicii were its ancient inhabitants. During the earlier period of its history, subsequently to the time of Henry II., it was more generally known by the name of Tyrconnell, and comprised the country of the O'Doherties, and that of two branches of the M'Swineys, besides whom the O'Gallaghers, O'Clerys, O'Donells, O'Boyles, and M'Canmeys, were leading families or septs. It is now divided into the six baronies of Bannagh, Boylagh, Innishowen, Kilmacrenan, Raphoe, and Tyrhugh, which are subdivided into fifty-nine parishes, besides four parts of parishes, the remainders of which extend into the adjoining counties. In the commencement of the reign of James I. the number of parishes was eighty-nine.

The county comprises the whole of the episcopal see of Raphoe, and a small part of that of Derry. The cathedral, which is built in Raphoe, a town otherwise of little notoriety, serves also for the parish church. Four clergymen's widows are lodged and maintained in the town upon a foundation of a bishop of the name of Foster, who also founded a free school here, and erected a building for a library, the books of which are a bequest from Dr Hall of Trinity College, Dublin. The diocese contains thirty-seven parishes, in which there are thirty-three churches. The total of the glebe land throughout the diocese is estimated at 11,370 acres of ground of every quality, giving an average of 307 acres to each parish. The bishop's income, according to a return made to parliament in 1831, is £5379. 14s. 1d. The barony of Innishowen, and the adjoining district, in the vicinity of the city of Londonderry, are in Derry diocese.

The face of the country in the south and east is comparatively level; all the western and northern regions are mountainous, interspersed, however, with valleys and occasional expanses of good land. The most fertile and improved part is the barony of Raphoe, containing the towns of Raphoe, Lifford, and Stranorlar, and embracing a tract about twenty miles long by twelve broad. The soil is good for potatoes, oats, barley, and flax; but wheat, though it thrives in some parts, particularly along the course of the

Finn river, is not much cultivated. The southern extremity of the county, in which the town of Ballyshannon stands, can also boast of some rich soil. The mountainous district, which spreads over more than one half of the county, after sloping from Belleek, on the borders of Fermanagh, in the south, to Barnesmore Hills northwards, turns westwards along the sea coast, by Killibegs, to the great promontory of Tellen Head; thence it spreads northwards over the waste expanse of the Rosses, and round by the north coast to Lough Swilly, and by Londonderry through Innishowen barony to Malin Head and Greencastle, where it is interrupted by Lough Foyle, but shows itself again in the northern parts of the counties of Londonderry and Antrim. The highest of these mountains is that of Arragh, which rises 2220 feet above the level of the sea, and is remarkable, not only for its superior elevation, but for one of the whin-dikes that are to be met with in Ireland only near the northern coasts; the dike rising forty feet perpendicularly, like a partition wall. Muckish Mountain, in Kilmacrenan barony, and Slieve Snaght, in Innishowen, are also of considerable height.

The soil is in general light, with a gravelly subsoil; though in some parts, as in the neighbourhood of Ballyshannon and Donegal, in the south, it is deep and rich, chiefly resting on a bed of limestone. The mountainous districts, though presenting little to excite the speculations of the agriculturist, possess much to attract the attention of the admirer of nature and the investigations of the scientific inquirer. The rugged precipitous declivities, intersected by winding bays and lakes imbedded in the valleys, exhibit an ever-changing variety of picturesque and magnificent scenery. The geological aspect of these regions affords indications of internal wealth which give ample grounds for regret that they have been so seldom made the subject of scientific research. The minerals as yet discovered are lead and iron. Mines of the latter of these metals were formerly wrought in the parish of Templecarne, until relinquished in consequence of the failure of timber for fuel. Manganese, yellow pyrites, and clay for potteries and brick-making, are also found. Siliceous sand, raised in Muckish Mountain, was conveyed in large quantities to Belfast for the manufacture of glass. Indications of coal have been observed near Lough Swilly, and at Inver on the southern coast.

The rivers, with the exception of the Foyle, which forms the boundary between this county and Tyrone and Londonderry, though numerous, are of very inferior size. The branches of the Foyle which rise in Donegal are the Derg, the Finn, and the Swilly, all of which originate in the central part of the county. The river itself, augmented by their contributions, and by those of several other branches from Tyrone and Londonderry, proceeds in a northern direction, and discharges itself into the southern extremity of Lough Foyle, at the city of Londonderry. It is navigable for vessels of large burden to this place, where their farther progress is prevented by a bridge; and thence by lighters of fifty tons as far as Lifford. Boats of fourteen tons can proceed up the Finn River as far as Castlefinn. The Erne flows from Lough Erne through the southern extremity of the county into Ballyshannon Bay. Its navigation is prevented by a fall of twelve feet in the neighbourhood of Ballyshannon, and by another of thirty feet at Belleek, on the confines of Fermanagh. The Guibarra, the Awen Ea, and the Eask, are the only other rivers of any note.

Lakes are numerous but small. Lough Derg, situate in Tyrhugh barony, between the counties of Tyrone and Fermanagh, is the most celebrated, yet not so much on account of its size, which is insignificant, or its scenic beauties, of which it possesses little, as from an island in it, named St Patrick's Purgatory, which is one of the most

Donegal.

Donegal. celebrated places of resort for pilgrims and devotees in Ireland. The extent of the island is less than an acre. The cave styled the Purgatory is formed of freestone; it is sixteen feet in length, two and a quarter in breadth, and so low that a man cannot stand upright in it. Several attempts made by the Roman Catholic hierarchy and by the government to prevent the performance of the ceremonies annually practised here have failed; it still continues to be a favourite place of worship. Loughs Eask, Ea, Gartan, Fearn, Finn, and Veagh, are worthy of note only as being the sources of some of the rivers which irrigate the country.

The bays and smaller inlets of the sea are numerous. Ballyshannon harbour, the most southern of them, is small, and has a bar at its mouth, as has Donegal and Inver harbours farther west. Killibegs harbour is well sheltered, and capable of receiving large vessels. On the western coast are Bruckles or M'Swiney's Bay, and Tellen harbour, suitable for small vessels; and on the north is Sheep Haven, within which is Dunfanaghy Bay, where the largest ships may lie in safety, as they may also in Mulroy Bay, farther east. Still farther eastwards is Lough Swilly, a capacious basin, plunging deep into the land, of easy access, and fit for vessels of any burden. Lough Foyle, the boundary between Donegal and Londonderry, may be more properly considered to belong to the latter county.

The islands of Arran constitute a small archipelago on the western coast, near the district called the Rosses. The herring fishery was carried on here with great spirit about fifty years ago, but is now nearly extinct, in consequence of the fish deserting the coast. A town called Rutland was built on Innismacdurn, one of these islands, for curing and exporting the fish. Tory Island lies off the northern coast, about eight miles from shore. The inhabitants have little intercourse with the rest of the county; they maintain themselves chiefly by fishing and making kelp. An engagement between an English and French squadron took place near this island in 1798. On Ennistrahul Island, off Malin Head, there is a lighthouse. Inch Island, in the southern extremity of Lough Swilly, is of considerable size.

The following table affords a correct view of the names, extent, and population of the islands along the coast of Donegal, as far as their points have been ascertained, commencing with the most southern.

Name.	Situation.	Extent in Acres.	Population.
1. Dromore.....	Donegal Bay.....	.....	13
2. Rosmore.....	Donegal Bay.....	.....	.....
3. Innisduff.....	Killibeg's Harbour	.....	16
4. Rockliburn....	Tellen Head.....	.....	.....
5. Ronanish.....	Daurus Head.....	.....	.....
6. Inniskeel.....	.....	.....	5
7. Inniskerah....	.....	.....	47
8. Eddernish.....	{ Templecroan } parish	.....	11
9. Eighter.....	Ditto.....	.....	42
10. Innisal.....	Ditto.....	.....	32
11. Innisdurn or } Rutland }	Ditto.....	183	173
12. Inniscoo.....	Ditto.....	.....	53
13. Tully.....	Ditto.....	.....	44
14. Duck.....	Ditto.....	.....	5
15. Islandcroan...	Ditto.....	.....	Uninhab.
16. Arranmore....	Ditto.....	2500	1010
17. Illanganna....	Ditto.....	.....	.....
18. Cruit or Croit..	Ditto.....	.....	335
19. Owey.....	Ditto.....	.....	76

Name.	Situation.	Extent in Acres.	Population.
20. Innisfree.....	{ Templecroan } parish	180	171
21. Gola.....	Ditto.....	.....	36
22. Innismana.....	Ditto.....	.....	5
23. Innisirhir.....	Ditto.....	.....	6
24. Innisinny.....	Ditto.....	.....	6
25. Reinrenny.....	Ditto.....	.....	14
26. Innisbofin.....	{ Bloody Far- } land Point }	400	252
27. Innisduh or } Dowey... }	Ditto.....	.....	22
28. Innisbeg.....	Ditto.....	.....	Uninhab.
29. Tory.....	Ditto.....	1200	296
30. Reagh or Ray	Mulroy Bay.....	.....	33
31. Inch.....	Lough Swilly.....	2000	1094
32. Aughnish.....	Ditto.....	.....	18
33. Big.....	Ditto.....	.....	15
34. Manor Cun- } ningham... }	Ditto.....	.....	Uninhab.
35. Clonmess.....	Sheephaven.....	.....	Uninhab.
36. Seal.....	Malin Head.....	.....	Uninhab.
37. Ennistrahul...	Ditto.....	.....	.....

The returns of the population, made at several periods by different authorities, give the following result:—

1789.....	Gewas P. Bushe, Esq.....	140,000
1812.....	Parliamentary census.....	No return.
1821.....	Ditto.....	248,270
1831.....	Ditto.....	298,194

The last of these returns gives an average of one individual to every four acres, or one family to every twenty-four acres; but if the arable land alone be considered, the average will be reduced to an individual to every two acres, or one family to twelve acres.

The representation in parliament is limited to the two county members. In the Irish parliament it had no less than twelve members; two for the county, and two for each of the boroughs of Ballyshannon, Donegal, Killibegs, Lifford, and Johnstown. The following table shows the variations of the constituency arising from the disfranchisement of the forty-shilling freeholders in 1829, and the subsequent alterations arising out of the provisions of the reform act:—

Number of Electors of the various rates of Suffrage.

Year.	L.100.	L.50.	L.20.	L.10.	40s.	Total.
1st Jan. 1829,		52	19	.....	2310	2381
1st Jan. 1830,		35	65	567	.....	667
1st May 1831,		811	92	66	.....	969
1st Jan. 1832,		...	...	...		1458

The preservation of the peace is entrusted to a force of six chief and ninety petty constables, acting under the authority of the magistrates, and maintained at an expense of L.5840, being an average of somewhat more than L.60 a man by the year.

The parliamentary returns as to the state of education in 1821 and 1824-26 give the following results:—

	Boys.	Girls.	Unascertained.	Total.
1821.....	5866	3655	—	9521
1824-26.....	7991	5474	337	13,802

Of the number in the latter of these returns, 4055 were of the established church, 6603 were Roman Catholics, 3058 dissenters, and eighty-six whose religious persuasion had not been stated. The total number of schools was 399; of these, 258, containing 7764 pupils, were wholly

Donegal. maintained by the fees of the pupils; eighty-eight schools, containing 4738 pupils, were supported by the voluntary contributions of societies or individuals; and but fifty-three schools, containing 3007 pupils, received grants of public money through the agency of a public board. A grammar school was founded in the town of Raphoe by James I., and endowed with a large grant of lands, which it still continues to enjoy under the regulations of commissioners appointed by the crown. Major Robinson, the son of a clergyman in Donegal town, bequeathed a large property for the maintenance of a school in every parish in the diocese of Raphoe, from which every teacher was to receive an annual salary of L.15.

The manners and habits of the people differ much, according to the local circumstances of the district they inhabit. The lowland and fertile districts are chiefly peopled by an industrious and comfortable yeomanry, composed of small farmers and artisans whose modes of life differ little from those in similar circumstances in the adjoining counties. In the mountainous and less cultivated tracts the want of a free intercourse, and the consequent tardy spread of manufacturing and agricultural improvement, have occasioned a corresponding tardiness in refinement of manners. Yet, so far as the state of crime may lead to a conclusion on this point, the population, though backward in the knowledge of the useful arts, are stained with few of the vices which indicate a demoralized state of society. Out of the total number of committals in 1830, amounting to 781, there were but 406 convictions; but three of these were capital, for horse stealing, and were commuted to transportation for life, and four were for transportation for seven years. Of the remainder, ninety were for illicit distillation, and thirty-seven for riotous assemblages, arising in many cases from the previously named offence. The nature of the country peculiarly favours the operations of the unlicensed distiller; but late statutes, mitigating the demoralizing severity of the revenue code, have already in some degree checked the practice. The houses, particularly in the mountainous parts, are poor. Little attention is paid to cleanliness. The pigs and other cattle, if any, are housed in them along with the family. The fuel is everywhere turf; the food potatoes and oaten bread, with milk and butter occasionally, and fish if near the sea. The men are clothed in home-made frieze, the women chiefly in cheap cottons. The Irish language still maintains its ground in the retired parts, though its use is every year diminishing. Adepts in the language consider the dialect spoken in this county as the purest known.

The modes of agriculture present little peculiar to the county. The spade still supplies the place of the plough in those parts where the rocky nature of the soil prevents the profitable application of the latter implement. In the southern parts a narrow spade with a long handle, and a resting place for the foot only on one side, is in common use. It is called a loy, and is peculiarly adapted to stiff clayey soils. Potatoes are planted with an implement called a steveen or kibbin, formed of a stake about four feet long, shod with iron, and having near the point a cross rest for the foot to act on when forcing it into the ridge; and the seed is dropt into the hole thus made. The cattle which are grazed on the coarse mountain pastures are subject to a kind of rheumatic affection called the cruppan. The animal becomes crippled, and, in the more aggravated stages of the disorder, is totally deprived of the use of its limbs; the hair on the back starts up, and atrophy succeeds, which terminates in death. The means of cure found most successful is the removal of the diseased animal to soil of another quality. If, however, it should remain for a year on the soil which cures this disorder, it is liable to

be attacked by another, called the galar, which causes a discharge of blood, followed by death unless prevented by a transfer to the pastures which had produced the former complaint. Horses are not subject to this latter malady. Feeding on cabbage and sea-rack has been suggested as a means for preventing the ravages of the cruppan. On the shores of Innisfree, one of the islands of North Arran, a species of grass, called by the inhabitants sweet-grass, springs up twelve feet under tide-mark of spring tides. It grows to the length of two or three yards, and is about the breadth of a compressed wheaten straw. At the lowest ebb of the spring tide the cattle run instinctively from the mountains to feed on this herb, as the greatest luxury, and persevere in so doing regularly at the particular period when the recess of the water leaves the plant exposed. In the mountain farms the fences are very bad, being formed of low turf ditches. In many cases the use of fences is disregarded, as a person is either sent to herd the cattle, or they are confined by tethers. The care generally taken to house cattle, in order to prevent the attacks of the cruppan, and to collect manure, renders the want of fences less injurious.

The manures in the neighbourhood of the sea are chiefly sea-weed, shelly sand, and house dung. Although the tract from Ballyshannon to Killibegs abounds with limestone and marl, the use of these as manures is not so great as their value, and the facilities of procuring them, would lead those unacquainted with the habits of the people to expect. Irrigation is general, and much encouraged by the landlords. Farming societies have been formed, and premiums offered, in order to excite a spirit of emulation in introducing improved modes of agriculture.

The herring fishery was carried on about fifty years ago to a great extent, and with considerable success, in the district of the Rosses, on the western coast. In the years 1784-85 the winter fishing produced L.40,000, and supplied cargoes for 300 vessels each year. Such was the success, that a fishing town, named Rutland, with suitable stores and curing houses, was built on the island of Innismacdurn; but the fishery shortly after declined, and has never regained its former character. The decay has been attributed to the summer fishing of what are called sprats, but thought to be the young herrings, which are thus carried off in myriads in a less profitable shape, and the full-grown fish deterred from the coast. Still, however, the fishery is carried on, though on a very reduced and fluctuating scale. The white fishery has latterly been more profitable. The following table will show the progress of both kinds, and the state of the fishing vessels during the period that the fisheries of Ireland were under the superintendence of a board empowered to make grants and loans of public money for their improvement.

Number of Vessels and of Men registered and employed in the Fisheries of Donegal.

	Decked.	Half Decked.	Open Sail.	Row Boats.	Men.
1822	5	0	9	505	4628
1823	1	0	13	1092	5789
1824	1	0	15	1114	5900
1825	3	1	16	892	4693
1826	1	0	17	987	5245
1827	0	0	17	1050	5484
1828	0	0	19	1125	5943
1829	0	0	19	1187	6361
1830	0	0	21	1259	6633

Donegal.

Number of Barrels of Herrings, and Cwts. of White Fish, marked for the Production Bounty, with the amount of Bounty granted.

Dongola
Donkaw.

BARRELS HERRINGS.				CWTS. WHITE FISH.						
Years.	Gutted with a Knife.	Gutted otherwise.	Bounty.	Cod.	Ling.	Hake.	Had-dock.	Glassen.	Total Cwts.	Bounty.
1822	346	122	L.99 5 9	40	26	71	...	82	219	L.47 9 0
1823	766	20	131 16 10	224	75	201	...	127	627	131 19 0
1824	1488	6	323 12 7	196	52	728	...	66	1042	222 1 8
1825	934	...	203 1 10	747	138	1783	4	347	2272	640 19 9
1826	1821	9	366 6 9	263	155	3695	6	279	4398	874 14 1
1827	1981	...	299 16 6	1546	280	3019	...	2342	7187	1215 4 0
1828	2083	...	247 0 6	893	72	2885	...	628	4478	1052 2 0
1829	...	...	...	1952	148	3186	...	2176	7462	1831 12 0
1830	356	...	17 16 6	4126	181	3740	...	3461	11508	1636 6 0

The fishery board also granted money in aid of building fishing piers at Green Castle in Lough Foyle, and Doaghbeg in Lough Swilly. In the project for the plantation of Ulster, drawn up in the early part of the reign of James I., twenty-five places in this county are named as being approved stations for the salmon, herring, and ling fishery. The principal salmon fishery at present is at Ballyshannon. Whale and sun-fish have been taken near the coast.

Manufactures never extend much beyond what the immediate demand of the population calls for. They are chiefly confined to linens and coarse woollens called friezes, of which latter a light blue is the favourite colour.

Numerous ruins of ancient castles along the coast prove that much attention was formerly paid to the defence of the country from invasion, or, what was more to be dreaded, piratical depredations. The principal are, Kilbarron Castle, near Ballyshannon; Donegal Castle, built by O'Donell; Burt and Inch Castles, both built in Lough Swilly, by Sir Cahir O'Dogherty, to whom is also attributed the erection of Green Castle on Lough Foyle. Near the Castle of Doe, or M'Swiney's Castle, at Horn Head, is a natural perforation in the roof of a cave, wrought by the workings of the ocean into the overhanging cliff. It is called M'Swiney's Gun. When the wind blows due north, and the tide is at half flood, the gun is seen to spout up jets of sea water to a great height, attended with explosions which are said to be heard in favourable weather at more than twenty miles distance. Culmore Fort, on the coast of Lough Swilly, is still maintained as a military station, at least so far as to afford a respectable income to some military person who performs the nominal duties of governor there.

Traces of religious houses, some however existing only in traditionary or documental records, are also numerous. Ashroe Abbey, on the Erne river, near Ballyshannon, was of great extent. The ruins of that of Donegal also afford proofs of its ancient grandeur. But its memory will be held in greater veneration by the lovers of antiquity for another reason. In it was written the celebrated collection of ancient Irish annals, still known by the name of the Annals of the Four Masters, compiled in the year 1632, by Michael O'Clery and his learned coadjutors, fellow brothers in that house, by the instigation and at the expense of Fergal O'Gara, lord of Moy O'Gara and Coolavin, in the county of Sligo. The original of this curious and highly valuable manuscript is now lodged in the library of the Royal Irish Academy.

The towns in this county are few and insignificant. Lifford, the county town, is situated near its south-eastern

extremity, on the river Foyle, and communicates by a bridge with Strabane, on the eastern bank of the same river, insomuch that it might almost be considered rather as a suburb of this more populous town, than as the metropolis of a county. Its population in 1821 amounted only to 976 souls. It can boast of no public buildings but those which owe their existence to the rank for which its position is so ill adapted, as attendance at the assizes here must be extremely inconvenient to residents in most of the other towns, which are chiefly near the sea-coast, at the other extremities. The buildings are a court-house, a prison, and an infirmary.

The reason given for fixing on a situation for the county town so inconvenient to the resident inhabitants, was, that the judges and barristers were saved the trouble of travelling far into a county in which the roads at that time were few and ill constructed, and the accommodation in the inns very inferior. The other towns of any consequence, with their population in 1821, are as follows:

Name.	Population.	Name.	Population.
Ballyshannon.....	3831	Ramelten	1247
Letterkenny.....	2458	Ballybofey	920
Raphoe.....	1433	Donegal	696

Ballyshannon, situate at the embouchure of the Erne, which is here crossed by a bridge of nine arches, is worthy of notice for its trade, the chief articles of which are corn and salmon; for the remains of antiquity in its immediate vicinity; and for the picturesque scenery with which it is surrounded, and which is much heightened by the salmon leap across the river.

DONGOLA, or DANKALA, a town on the Nile, and capital of the district of Nubia. It stands on the declivity of a dry, arenaceous hill, and the streets are almost choked with sand brought down from the mountains behind by the floods. The houses are low and ill built. The castle is situated in the middle of the town, and is spacious, but badly fortified. The horses of Dongola are highly prized; they are remarkably beautiful, and their riders are very skilful. When the Mamelukes were expelled from Egypt, a party of those who escaped took possession of Dongola, and erected there a species of petty sovereignty. Their number, however, does not exceed 500, with from 3000 to 6000 negro slaves. Long. 32. 0. E. Lat. 19. 20. N.

DONKAW, a circle in the Russian government of Riasan, bounded on the north by Skopin, on the north-east by Miahsh, on the east by Ranenburg, on the south by Tambow, and on the west by Tula. It is watered by the river Don, and has but little wood, but some good arable land, producing rye and other corn, and feeding black

Donne
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Doonah.

cattle. The inhabitants amount to 75,500. The chief town, of the same name, is situated on the Don, and contains six churches, a monastery, 351 houses, and 2100 inhabitants.

DONNE, DR JOHN, a poet and divine, was born in the city of London in 1753. His parents were of the Catholic religion, and used their utmost efforts to keep him firm in the same persuasion; but an early examination of the controversy between the church of Rome and the Protestants determined him to adhere to the creed of the latter. He travelled into Italy and Spain, where he made many useful observations, and learned the languages of both countries to perfection. Soon after his return to England, Sir Thomas Egerton, keeper of the great seal, appointed him his secretary, and in this post he continued during five years. He married privately Anne, the daughter of Sir George Moore, then chancellor of the garter, and niece to the lord keeper's lady, in consequence of which he was dismissed from his place and thrown into prison. But he was afterwards reconciled to Sir George by the good offices of Sir Francis Wooley. In 1612 he accompanied Sir Robert Drury to Paris. During this time many of the nobility solicited the king to give him some secular employment. But his majesty, who took pleasure in his conversation, had engaged him in writing his *Pseudo-Martyr*, printed at London in 1610; and he was so highly pleased with that work, that, in 1614, having prevailed on the author to enter into holy orders, he appointed him one of his chaplains, and procured him the degree of doctor of divinity from the university of Oxford. In 1619 Dr Donne attended the Earl of Doncaster in his embassy into Germany. In 1621 he was made dean of St Paul's; and the vicarage of St Dunstan in the West soon afterwards fell to him. Besides the above work, he wrote, 1. Devotions upon emergent Occasions; 2. The Ancient History of the Septuagint, translated from the Greek of Aristæas, 1633, in 12mo; 3. Three volumes of Sermons, 1640, 1649, 1660, folio; 4. A considerable number of Poems; and other works.

Donne's writings show him to have been a man of wit and learning; but his greatest excellence consisted in satire. Lord Falkland, no mean judge, styles him one of the most witty and most eloquent of modern divines. His reputation as a poet was higher in his own time than it has been since. Dryden, with his usual judgment and discrimination, characterises him as "the greatest wit, though not the best poet, of our own nation;" and adds, that "he affects metaphysics, not only in his satires, but in his amorous verses, where nature only should reign, and perplexes the minds of the fair sex with nice speculations of philosophy, when he should engage their hearts, and entertain them with the softnesses of love." Donne's numbers, if they may be so called, are certainly the most rugged and uncouth of any of our poets; yet he was certainly not ignorant nor unskilled in the higher attributes of style, for he wrote elegantly in Latin, and displays considerable taste in some of his smaller pieces and epigrams.

DONNINGTON, a market-town of the hundred of Kirton, in the county of Lincoln, 106 miles from London, and situated in a fenny district, having a water communication with Boston. The market is on Saturday. The inhabitants amounted in 1801 to 1321, in 1811 to 1528, in 1821 to 1638, and in 1831 to 1759.

DONSKAIA, a fortress of Asiatic Russia, situated on the brook Taschle, the first of a chain of posts established between the Sea of Azof and the Caspian. It contains about forty houses; and adjacent to it is a village of Cosacks. It is 116 miles north-north-west of Ekaterinograd.

DOOMSDAY BOOK. See DOMESDAY BOOK.

DOONAH, a town of Hindustan, in the province of

Gundwana, thirty miles south from the town of Gurrah. Long. 80. 3. E. Lat. 22. 48. N.

DOONDEAKERA, a town of Hindustan, in the province of Oude, situated on the north-east side of the Ganges. The adjacent country abounds with game and wild cattle of a small breed. Long. 80. 40. E. Lat. 26. 12. N.

DOORNICK. See TOURNAI.

DOORYGHAUT, a town of Hindustan, in the province of Allahabad, and district of Gazypoor, situated on the south side of the Goggrath, and seventy miles north-east from Benares. Long. 83. 31. E. Lat. 26. 15. N.

DOORYDROOG, a fortress of the south of India, in the province of Mysore, situated on a rock. Long. 77. 25. E. Lat. 13. 27. N.

DOOSHAK, a town of Persia, the capital of the province of Seistan, situated in an open country, about eight or nine miles from the river Heermund or Helmund. The modern city is small, but compact; and the ruins cover a vast extent of ground. It is populous, has a good bazar, and the inhabitants, dressed in the Persian manner, have a more civilized appearance than the other natives of Seistan, who are either Patan or Balouche shepherds, and live a wandering life, pitching their tents amidst the ruins of ancient palaces. The neighbouring country produces wheat and barley in sufficient quantities to be exported to Herat. The pasturage is also good and abundant. This place is called also Julallabad, and is governed by an independent prince, who calls himself king of Seistan. Long. 61. 13. E. Lat. 31. 26. N.

DOR, the English name of the common black beetle. Some apply the term also to the dusty beetle, which flies about hedges in the evening.

DORADO, in *Astronomy*, a southern constellation, not visible in our latitude. It is also called *xiphias*.

DORAK, or FELAH, a town of Persia, in the province of Kuzistan, situated on two branches of the river Jerahi, in low and marshy ground. It is surrounded by walls about two miles in circumference, built of mud, sixteen feet in thickness, and flanked at regular distances with round towers. It contains few houses within the walls, as the majority of the people, amounting to 8000, prefer living in the suburbs, under the shade of date trees. The palace of the scheik covers a large space of ground, but is in reality a miserable structure, built of bricks dried in the sun, and rapidly going to decay. It is celebrated for its manufacture of Arabian cloaks, which are exported in great numbers all over Arabia and Persia, but it has little other trade. It is seventy-five miles south of Shuster.

DORAN, a town of Arabia, in the county of Yemen, the residence of a chief or governor. It was formerly surrounded by a wall with three gates. It is twenty-eight miles south of Sana. Long. 44. 4. E. Lat. 14. 55. N.

DORAT, a town of the department of the Upper Vienne, in France, on the river Sèvre. It is in an agreeable situation, contains 349 houses, and 2264 inhabitants, who are mostly makers of hats. Long. 1. 1. E. Lat. 46. 10. N.

DORCHESTER, a town in Oxfordshire, in the hundred of the same name, fifty-two miles from London, on the banks of the Thame. It was formerly the see of a bishop, and the cathedral, which still remains, is used as the parish church. The inhabitants amounted in 1801 to 777, in 1811 to 754, in 1821 to 854, and in 1831 to 866.

DORCHESTER, a town, the capital of the county of Dorset, 120 miles from London. It rises gradually from the banks of the Frome, and is a well-built town, formerly celebrated for its breweries of strong beer, but now with little trade, and no manufactures. It was a Roman station, and near it are an amphitheatre and two camps constructed by that nation, together with the remains of their wall. The assizes and elections are held here. The market is

Doondea-
kera
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Dorches-
ter.

Dordogne held on Saturday. It returns two members to parliament, chosen by the householders and freeholders; but the adjoining parish of Fordington has now been added to it. The inhabitants amounted in 1801 to 2402, in 1811 to 2546, in 1821 to 2743, and in 1831 to 3033.

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Doria.

DORDOGNE, a department of France, formed out of the country of the ancient Perigord and a small part of Limousin. It is bounded on the north by Upper Vienne, on the east by Corrèze and Lot, on the south by Lot and Lot Garonne, on the west by the Gironde and Lower Charente, and on the north-west by the department of Charente. Its extent is 3740 square miles, or, according to the royal almanack, 898,274 hectares. Its surface consists of mountains, many small hills, and narrow valleys. The soil in general is stony, and by no means fruitful. The calcareous hills are mixed with sandy and clayey soils abounding in flints. It is well watered both by rivers and small streams, of which more than 1400 are enumerated in the statistical and topographical description of the department. The agriculture is in a backward state, the chief corn is maize, which forms the principal bread of the people; but of late the great extension of the potato culture has provided a useful substitute for bread. The chestnut woods, which are said to occupy one fifth of the surface, furnish also a large portion of the subsistence of the inhabitants. Sheep and goats are bred in considerable numbers, and large herds of swine are supported near the chestnut woods. Some districts yield a good white wine; but the whole quantity produced is inconsiderable. The chief exports consist of wine, chestnuts, wall and hazelnuts, nut oil, truffles, cattle, wool, and leather. The manufactures are few. Some iron wares are made, from mines in the department. The inhabitants amount to 424,113, of whom 8500 are Protestants. The language is a patois of Italian and French. The capital of the department is the city of Périgueux.

DORHEIM, a circle in the province of Hanau, in the duchy of Hesse-Cassel, comprising two market-towns, two villages, and 3812 inhabitants. The chief place, of the same name, situated on the river Wetter, contains 1194 inhabitants.

DORIA, ANDREW, a gallant Genoese sea officer, born in 1466. He entered into the service of Francis I. of France, but preserved that spirit of independence which is so natural to a sailor and a republican. When the French attempted to render Savona, long the object of jealousy to Genoa, its rival in trade, Doria remonstrated in a high tone against the measure; and this bold action, represented by the malice of the courtiers in the most odious light, irritated Francis to such a degree that he ordered his admiral Barbesieux to sail for Genoa, then in the hands of the French troops, to arrest Doria, and to seize his galleys. But Doria got a timely hint of this rash order; retired with all his galleys to a place of safety; and, whilst his resentment was warm, closed with the offers of the emperor Charles V. returned his commission with the collar of St Michael to Francis, and hoisted the imperial colours. To deliver his country, now weary alike of the French and the imperial yoke, from the dominion of foreigners, was Doria's highest ambition; and the favourable moment had presented itself. Genoa was afflicted with the pestilence, and the French garrison being ill paid and greatly reduced, the inhabitants were sufficiently disposed to second his views. He sailed to the harbour with thirteen galleys, landed five hundred men, and made himself master of the gates and the palace with very little resistance. The French governor with his feeble garrison retired to the citadel, but was soon forced to capitulate; upon which the people ran together, and levelled the citadel with the ground. It was now in Doria's power to have rendered

himself the sovereign of his country; but, with a magnanimity of which there are few examples, he assembled the people in the court before the palace, disclaimed all pre-eminence, and recommended to them to settle what form of government they chose to establish. The people, animated by his spirit, forgot their factions, and fixed that form of government which, with little variation, subsisted until the year 1815. This event happened in 1528. Doria lived to a great age, respected and beloved as a private citizen; and he is still celebrated in Genoa by the most honourable of all appellations, the father of his country, and the restorer of its liberty.

DORIANS, a people of Greece, who derived their origin from those districts in which the Grecian nation bordered towards the north upon numerous and dissimilar races of barbarians. According to Herodotus, they were from early times one of the chief races of that nation, which, in fact, was composed of Dorians and Ionians; the one of Hellenic and the other of Pelasgic origin, the former a migratory and the latter an aboriginal race. In this definition it is assumed that the Pelasgi were Greeks and spoke the Grecian language in its elder form; an opinion in support of which many arguments might easily be produced. But all the races whose migrations took place at a comparatively late period, such as the Achæans, Ionians, and Dorians, particularly the last, were not sufficiently numerous or powerful to effect a complete change in the customs of a barbarous population: many districts, as Arcadia and Perrhæbia, remained entirely Pelasgic, without being inhabited by any nation not of Grecian origin: the most ancient names either of Grecian places, or those mentioned in the traditions of the Grecian race, belonged indeed to a different era of the dialect, but not to a different language; and, lastly, the great similarity between the Latin and the Greek can only be explained by supposing the Pelasgic language to have formed the connecting link. The Dorians are mentioned in ancient legends and poems as having been established in one extremity of the great mountain chain of Upper Greece, namely, at the foot of Mount Olympus; but there are, nevertheless, many reasons for supposing that, at a period still earlier than that to which these monuments refer, they dwelt at its other extremity, reaching to the farthest limit of the Grecian nation. Indeed the Doric Hylleans had a tradition that they came originally from those northern districts which bordered on the Illyrians, and were afterwards occupied by that people; a tradition, we may observe, which many facts and circumstances unite to confirm, or at least to render highly probable. Be this as it may, however, the earliest ascertained seat of the Dorians was the district of Mount Olympus. But, either from a restless and wandering disposition, or impelled by the pressure of some northern hordes, they seem to have migrated from this district into Crete, that is, from one end of the Grecian world to the other; thus presenting a striking anomaly in the history of the ancient colonies. The earliest trace of this circumstance is found in the Odyssey, where it is mentioned that the "thrice divided" (*τρίχαιρες*) Dorians formed part of the population of Crete. Though originally inhabiting a mountainous region, they appear, in course of time, to have become, as it were, the Normans of Greece, and to have sought settlements wherever they could find them. But the most important, and the most fertile in consequences, of all the migrations of the Grecian races, and that which continued even to the latest period to exert its influence upon the Greek character, was the expedition of the Dorians into the Peloponnesus. This circumstance is mentioned by Herodotus, who states that, under Deucalion, they dwelt in Phthiotis, and in the time of Dorus, the son of Helen, inhabited the country at the foot of Ossa and Olympus, called Hestiaotis;

Dorians.

Dorians. that, afterwards, being driven from Hestiaeotis by the Kadmeans, they dwelt under Mount Pindus, and were called the Macedonian nation; that thence they again migrated to Dryopis, and from Dryopis passed into the Peloponnesus, where they were called the Doric race. The traditionary name of the expedition in question is "the Return of the descendants of Hercules," who are admitted to have been of Doric origin; and, in process of time, successive conquests were effected by them in the Peloponnesus, until the whole of that country was at length subdued and occupied by the Dorians. Argos was captured by this people; Sicyon was conquered from Argos, Phlius from Sicyon, and Cleonae from Argos. The Dorians expelled the Ionians from Epidaurus, and afterwards reduced Aegina and Troezen; they appear also to have made themselves masters of Corinth and Megara; and, under Aristodemus, they conquered Laconia, which soon afterwards rose into great importance among the states of Greece. In due time, Doric colonies from Argos, Epidaurus, and Troezen established themselves on the south-west coast of Asia Minor; and other colonies of the same race also settled in different parts of the same country, where, at a very early period, we find them forming a league against the Ionians, whom they had either encroached upon or expelled. In fact, there is nothing so remarkable in the history of this remarkable race as its extraordinary propagation and diffusion. In course of time it spread itself on all sides, from Greece to Asia Minor, Byzantium, Syracuse, and the country which sweeps round the Gulf of Tarentum, including the territory afterwards known by the name of Magna Graecia, with Crotona, Locri, and Lyctus, to say nothing of Chalcis, Solium, Ambracia, Anactorium, Leucadia, Corcyra, Epidamnus, Apollonia, Potidaea, Chalcedon, Trogilus, Thapsos, Selinus, and other places, which it conquered or colonized. It is remarkable that, wherever any portion of Doric invaders or settlers proceeded, they not only carried along with them, but gave a permanent ascendancy to the peculiarities and characteristics of their race. Their religion, their laws, their literature, their manners, and in short all that distinguished them as a separate people, appear to have taken root wherever they pitched their tents; and it is by the vestiges which still remain of their migrations, settlements, and power, that we are enabled to trace with some degree of certainty events which either took place before the commencement of authentic history, or in regard to which history, tradition, and even fable, are alike silent. The limits of this article, however, preclude our entering into details, which in fact would require volumes for their full development and illustration. We shall therefore confine ourselves to some general remarks on the character of the Dorians, deduced from the masterly analytical investigations of Professor Müller in his *History and Antiquities of the Doric Race*; a work not more distinguished for its almost boundless erudition, than for the critical sagacity and philosophic spirit which is displayed in it throughout.

And the first peculiarity in the Doric character which we shall notice, is the tendency which it exhibited to produce uniformity and unity. Every individual was destined to remain within those limits which were prescribed by the will of the whole; every one was bound to obey in his own place. All the smaller associations were regulated on the same principle; there was a gradation of power, but never independent equality. The Dorians, also, had little inclination to admit the customs of others, and a strong desire to disconnect themselves from foreigners; their instinct seems to have been to adhere scrupulously to their own national habits, and to preserve that distinct individuality of national character which appears to have given them so decided an ascendancy over all the races amongst which they intermingled or settled. They loved independence,

Dorians. and knew well how to maintain and defend it. A calm and steady courage was the natural quality of the Dorians; and though they sometimes yielded to the impetuosity of excitable and enthusiastic enemies, their fortitude and pertinacity commonly secured them the victory, and almost always prevented defeat from degenerating into disaster. As they were not ready to receive, neither were they prone to communicate, outward impressions; and hence, both in their poetry and prose, the narrative is often concealed by expressions of the feeling, and tinged as it were with the hue and colour of the mind. They endeavoured always to condense and concentrate their thoughts, which was the cause of the great brevity and obscurity of their language; and as their attention was turned to the past rather than the future, they cherished an ardent attachment to the usages and manners of their forefathers, as embodied and preserved in their actual institutions. Hence the Dorians preserved most rigidly, and represented most truly, the customs of the ancient Greeks. They were not a stationary, far less a retrograding people; but the advances which they made were slow, and all their changes imperceptible.

With the desire to attain uniformity, for which the Dorians were distinguished, there was also combined in their character another remarkable peculiarity; namely, a love for measure and proportion. Their works of art are conspicuously marked by this attention to singleness of effect; and every thing discordant or useless was pruned off with an unsparing hand. Their moral system also prescribed the observance of the proper medium in all things; and it was in this that the temperance which so distinguished them consisted; it was the synonyme, not of abstinence, but of moderation. One great object of the worship of Apollo, which the Dorians introduced into Greece, was to maintain undisturbed the balance of the mind, and to remove every thing calculated to disquiet the thoughts, inflame the passions, or overcloud the serenity of the soul. The nature of this singular race seems to have required an equal and regular harmony; and for this reason dissonances, even if combined into harmony, were by no means suited to their taste. The national song was doubtless not remarkable for soft or pleasing melody; and the general accent of the language had the tone and character of command, without any of that delicacy or flexibility which are required in Elysian airs or Lydian measures. But the Dorians were contented with themselves, and with the powers to which they owed their existence and their happiness; in almost every sense, they were a self-concentred race, living in themselves and for themselves; they looked not to future, but to present existence, and they loved their own laws, religion, institutions, manners, customs, literature, and arts, too much to envy those of other nations, or even to desire to imitate them. Man was the chief and almost only object which attracted their attention. This feeling may be detected in their religion, which was always unconnected with the worship of any natural object, and originated solely from their own reflections and conceptions; and to the same source may perhaps be traced their aversion to mechanical and agricultural labour, a feeling which belongs and is indeed natural to minds of a contemplative turn. In a word, the whole Doric race bears the stamp and character of the male sex among nations; the desire of assistance and connection, of novelty and curiosity, the characteristics of the weaker sex, being directly opposed to the nature of the Dorians, which, from first to last, was marked by severe simplicity, inflexible independence, subdued strength, and unquenchable nationality. (See Müller's *History and Antiquities of the Doric Race*, English translation, Oxford, 1830, 2 vols. 8vo.) (A.)

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DORIC, in general, any thing belonging to the Dorians. DORIC, in *Architecture*, is the second of the five orders, being that between the Tuscan and Ionic. See ARCHITECTURE.

DORIC *Dialect*, one of the five dialects, or forms of speech, which prevailed among the Greeks. It was first used by the Lacedæmonians, and particularly by those of Argos; and thence it passed into Epirus, Libya, Sicily, and the islands of Rhodes and Crete. In this dialect wrote Archimedes and Theocritus, who were both of Syracuse, as likewise Pindar.

In strictness, however, we should rather define Doric the manner of speaking peculiar to the Dorians, and which afterwards came to prevail among the Lacedæmonians and other states. Some even distinguish between the Lacedæmonian and Doric; but in reality, setting aside a few particularities in the language of the Lacedæmonians, these dialects were the same; as indeed is shown by Rulandus in his treatise *De Lingua Græca ejusque Dialectis*.

Besides the authors already mentioned as having written in the Doric dialect, we might add Archytas of Tarentum, Bion, Callinus, Simonides, Bacchylides, Cypselas, Alcmeon, and Sophron.

Most of the medals of the cities of Græcia Magna and Sicily savour of the Doric dialect in their inscription: thus, AMBPAKIΩTAN, AΠOΛΛΩNIATAN, AXEOPONTAN, AXYPITAN, HPAXAEΩTAN, TPAXINION, ΘEPMITAN, KATAONIATAN, KOPIATAN, TATPOMENITAN. These names indicate the countries in which the Doric dialect was used.

The general rules of this dialect are laid down by the grammarians of the Port-Royal; but they are much better explained in the fourth book of Rulandus, where he even notes the minuter differences of the dialects of Sicily, Crete, Tarentum, Rhodes, Lacedæmon, Laconia, Macedonia, and Thessaly. The omega abounds everywhere in the Doric; but this dialect bears so close a conformity to the Æolic, that many reckon them but one. (See Müller's *History and Antiquities of the Doric Race*, vol. ii. appendix.)

DORIC *Mode*, in *Music*, the first of the authentic modes of the ancients. Its character is severity tempered with gravity and joy; and it was proper upon religious occasions, as also used in war. Plato admires the music of the Doric mode, and judges it proper for preserving good manners, from being masculine in its character; on which account he allows it in his commonwealth. The ancients had likewise their subdoric or hypodoric mode, which was one of the plagal modes. Its character was also very grave and solemn, and it begins a fourth lower than the Doric.

DORING, or DARING, among sportsmen, a term used to express a method of taking larks, by means of a clapnet and a looking glass. For this sport there must be provided four sticks very straight and light, about the size of a pike; and two of these must be about four feet nine inches long, and all notched at the edges or the ends. At one end of each of these sticks there is fastened another of about a foot long on one side; and on the other side a small wooden peg about three inches long. Then four or more sticks are prepared, each of them one foot in length; and every one of these must have a chord of nine feet long fastened to it at the end. Each should be provided with a buckle for the commodious fastening on of the respective sticks when the net is to be spread. A cord must also be provided, having two branches. The one must be nine feet and a half, and the other ten feet long, with a buckle at the end of each; the rest of the cord must be twenty-four yards long. All these cords, as well the long ones as those about the sticks, must be well twisted, and of the thickness of one's little finger. The next thing to be pro-

vided is a staff four feet long, pointed at one end, and with a ball of wood at the other, for carrying these conveniences in a sack or wallet. There should also be carried a spade to level the ground where there may be any little irregularities, with two small rods, each eighteen inches long, and having a small rod fixed with a pack-thread at the larger end of one of them. To these are to be tied some pack-thread loops, in order to fasten the legs of some larks; and there must also be reels, that the birds may fly a little way up and down. When all this is done, the looking-glass is to be prepared in the following manner. Take a piece of wood about an inch and a half thick, and cut it in the form of a bow, so that there may be about nine inches space between the two ends; and let it have its full thickness at the bottom, that it may receive into it a false piece, in the five corners of which there are to be set in five pieces of looking-glass. These must be so fixed as to dart their light upwards; and the whole machine must be supported on a moveable pin, with the end of a long line fixed to it, and made in the manner of the children's plaything called an apple and a plumstone; so that one end of the cord being carried through a hedge, the barely pulling it may set the whole machine of the glass a turning. This and the other contrivances are to be placed in the middle between the two nets. The larks fixed to the place, and termed *calls*, with the glittering of the looking-glasses as they twirl round in the sun, invite the other larks down; and the cord which communicates with the nets, and goes through the hedge, gives the person behind an opportunity of pulling up the nets, so as to meet over the whole, and take every thing that is between them. The places where this sort of sporting succeeds best are open fields remote from any trees and hedges, except one by way of shelter for the sportsman; and the wind should always be either in the front or back, for if it blows sidewise, it prevents the playing of the net.

DORKING, a market-town of the hundred of Wooton, in the county of Surrey, twenty-four miles from London. It is in a good situation, at the junction of two valleys, on a gentle elevation. There is a fine church, formerly collegiate. The market is held on a Thursday. The inhabitants amounted in 1801 to 3058, in 1811 to 3259, in 1821 to 3812, and in 1831 to 4711.

DORMANS, a city of the department of the Marne, in France, on the left bank of the river Marne, with 428 houses, and 2275 inhabitants, who carry on a great trade both in corn and in wine of Champagne.

DORMANT, in *Heraldry*, is used for the posture of a lion, or any other beast, lying along in a sleeping attitude, with the head on the fore paws; by which it is distinguished from the *couchant*, where, though the beast is lying, yet he holds up his head.

DORMER, in *Architecture*, signifies a window made in the roof of a house, or above the entablature, being raised upon the rafters.

DORMITORY, a gallery in convents or religious houses, divided into several cells, in which the religious sleep or lodge.

DORNBERG, a circle in the grand duchy of Hesse-Darmstadt, comprising the town of that name, and twenty-seven villages, with 1093 houses, and 7732 inhabitants.

DORNBIRN, a market-town of the circle of Bregentz, and Austrian province of Tyrol. It stands on the river Fussach, and is a flourishing place, owing to its manufactories of muslins and cotton cambrics, and its mills for spinning flax. It contains more than 4000 inhabitants.

DORNOCH, a royal burgh of Scotland, in the county of Sutherland. It is situated on the northern coast of the Frith of Dornoch, on a low sandy beach, nearly opposite the burgh of Tain, which lies on the south side of the frith.

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It is of considerable antiquity, and was formerly the seat of the bishops of Caithness, who had here a spacious castle. The parish church is part of the cathedral, which is supposed to have been erected in the eleventh century. Dornoch, although the seat of the county courts, is a mere village, with little or no trade. The population of the town and parish amounted in 1821 to 3100, and in 1831 to 3380.

DORNOCH FRITH, an arm of the sea on the eastern coast of the Highlands of Scotland, serving as the boundary between the counties of Ross and Sutherland for several miles. It is twelve miles broad at its mouth, and here has more the character of a bay than of a frith. It gradually becomes narrower, till, within three miles west from the town of Dornoch, its breadth decreases to two miles. Above this point it becomes much broader, forming an inner harbour or bay. There are several ferries upon this frith, and near its head it is crossed by an iron bridge, where also the rivers Oykel and Shin empty their waters.

DOROBAT, a small town of Arabia, in the country of Yemen, the capital of a district situated on the crest of a mountain, remarkable for a prison excavated from the rock, where malefactors are secured by long chains. It is twelve miles west of Taas.

DORONINSK, a town of Asiatic Russia, in the government of Irkutsk, situated on the river Ingoda, 208 miles east-south-east from Irkutsk.

DORPAT, a circle in the Russian province of Livonia, but formerly of Esthonia. It extends over 3420 square miles, and contains a population of 137,415 souls, in two cities and twenty parishes, with 206 noble residences, and 15,331 peasants' dwellings. The chief place, the city of the same name, is situated on the great Embach. It is an open city, built in the German style, and by far the best constructed of any place in Livonia. It has a Greek and a Lutheran church, 1200 houses, and about 10,000 inhabitants. It is chiefly remarkable on account of its university, which is the best in Russia, both as regards its professors, and the appropriate collections necessary for instruction in the higher branches of science, particularly of astronomy. There are also good preparatory schools. Long. 26. 37. 45. E. Lat. 58. 22. 47. N.

DOROGOBUSH, a circle in the European Russian government of Smolensko. It occupies both sides of the river Dnieper, and is tolerably fruitful and well cultivated. The chief place is the city of the same name. It is the seat of a bishop; is neatly built, mostly of stone; and contains 3990 inhabitants, who chiefly subsist by the trade on the river Dnieper.

DOROHOE, a circle of Moldavia, in the northernmost part of that principality, watered by the rivers Pruth, Sireth, Schiga, and Bascheu. The capital is of the same name. It is situated on the side of a lake, is a large but not compact town, and, like the other towns in Moldavia, is filthy and badly built. It contains many churches and monasteries, has a weekly market, and is the seat of the court of law for a part of the province.

DORSETSHIRE, an English county, situated on the south-western coast. In British times, and previous to the landing of Cæsar, it was inhabited by the Durotriges and Morini, two appellations derived from the British language, and signifying dwellers on the coasts of the ocean. By the Romans this county constituted a portion of *Britannia Prima*; and the Saxons called it Dorsetta (a word having the same meaning as the above British appellation), and included it in the kingdom of Wessex. Kingston Hall and Corfe Castle are mentioned as royal residences.

On the north Dorsetshire is bounded by Somersetshire and Wiltshire, on the east by Hampshire, on the west by Devonshire and a part of Somersetshire, while the British Channel bounds it on the south. The irregularities of

its form prevent its being compared to any determinate figure; the northern boundary has a considerable angular projection in the middle; the southern coast runs out in various points and headlands; and the western coast inclines towards Devonshire, with an irregular line. Its greatest length from north to south is about thirty-five miles, and its breadth from east to west fifty-five; its circumference, including about 775,000 acres, is nearly 160 miles.

Dorsetshire is divided into thirty-four hundreds, containing more than 390 parishes, nine boroughs, and twenty-two market-towns, the principal of which are Dorchester, Bridport, Sherborne, Lyme-Regis, Shaftesbury, Wareham, Weymouth, Melcombe Regis, Poole, and Blandford. This county formerly returned twenty members to the House of Commons; but by the recent law it will only elect thirteen, viz. three for the county, two for Dorchester and for Poole, and the two boroughs of Weymouth and Melcombe Regis, now formed into one, will elect two members; Bridport, Lyme, Shaftesbury, and Wareham, each of which towns returned two, will in future elect but one. Corfe Castle has been disfranchised. Dorsetshire forms part of the see of Bristol. Its bishop was established at Sherborne by Henry the Eighth, but was shortly added to the diocese of Bristol. In remote times it had been a part of the sees of Oxford, of Salisbury, and of Winchester successively.

The surface of Dorsetshire is hilly and uneven. A great portion of the county has the appearance of downs, open and uninclosed portions, covered with sheep. More sheep are pastured in the neighbourhood of Dorchester than in any other district, though great numbers of both sheep and oxen are fed in the valley of Blackmore, which is celebrated as rich pasture land, containing upwards of 170,000 acres. There are also in this district several orchards, producing excellent cider. On the south-western side there are many vales of great luxuriance; but on the south-eastern there is much waste land, dreary and barren, hardly supporting, even in the summer months, a few sheep and cattle, and supplying the neighbouring villages with heath for fuel. Even in this region, however, cultivation is advancing, and detached portions are improved. The turnpike-roads in this county are numerous, rendering travelling easy and commodious.

These downs are principally of a light chalky soil, with a turf remarkably fine, producing hay, in the inclosed parts, of an excellent quality, on which beasts will thrive well in winter without any other food. About Bridport the lower lands are mostly a deep rich loam; but on the hills, throughout the western district, the soil is a sandy loam, intermixed with flint, well adapted for the growth of beech. To the north of Sherborne, where is some of the best land in the county for the plough, it is a stone brack, which is the case in the Isle of Portland and the Isle of Purbeck. In the centre of the county the soil is good and the land well managed.

Dorsetshire is not a well-wooded county; and, in general, native timber is scarce and dear. In some local spots, where the land is cold and wet, such as Duncliff in the vale of Blackmore, Heycombe Wood in the vale of Sherborne, and others of a similar nature, some plantations may be seen.

The air of Dorsetshire is remarkably mild and salubrious; which, added to the beauty of its scenery, has obtained for it the appellation of the Garden of England. Weymouth has long been celebrated as a fashionable watering-place; and, owing to the general calmness of the sea there, its pleasant situation, and its commodiousness for bathing, it has, through the frequent visits of the royal family, risen to great consequence.

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The chief port in the county is Poole, situated on an estuary formed by the mouth of the Frome. Its entrance is defended by Brownsea Castle, and it is very secure in all winds. It is the chief place for equipping ships for the Newfoundland fishery; and considerable trade is carried on from it with Spain, Portugal, and the Mediterranean. Swanage, Weymouth, Bridport, and Lyme have harbours capable of admitting small vessels only.

The rivers of Dorsetshire are the Frome, the Stour, the Piddle, and the Ivel. The Frome rises in the north-western part of the county, near Evershot; and, passing by Dorchester, reaches Poole, and falls into its bay. The Stour enters this county from Wiltshire, near Gillingham, and, pursuing a southern and south-eastern direction, enters Hampshire. The Piddle rises in the north, and, flowing to the south-east, unites with Poole Bay. The Ivel, anciently Yoo, has its origin from several springs near Horethorn, in a hill north-east from Sherborne, from which town it flows into Somersetshire, and falls into the Parret.

Although neither coal nor any metallic ores have ever been worked in Dorsetshire, the stone quarries of Purbeck and Portland have long been celebrated. Purbeck, though called an island, is more properly a peninsula, of an irregular oval form, about twelve miles in length and seven in breadth. The soil is altogether calcareous, and for the most part a continued mass, either of white or a brownish limestone, the latter having a mixture of sea-shells. The quarries on the south side of the isle afford an inexhaustible fund of natural curiosities. The best quarries are at Kingston, Worth, Langton, and Swanwick. The Swanwick stone is white, full of shells, takes a polish, and looks like alabaster. About Wareham and Morden is found a stone of an iron colour, called fire-stone. Near Dunshay, marble of various colours, blue, red, gray, and spotted, is dug up; but all of a coarse grain. Much of the stone of this district was used in the building of St Paul's Cathedral, Westminster Bridge, and Ramsgate Pier, and may be discovered in many of our ancient cathedrals, churches, grave-stones, and monuments. One of the most valuable products of Purbeck is a white clay used for making pipes, and very extensively applied to the manufacture of China. Large quantities of it are dug, and many vessels loaded with it for Staffordshire, at Russell Quay, within the port of Poole.

The rocks in the Isle of Portland rise frequently to 100 or 150 feet in height, and large masses lie scattered on the shore. These are composed of calcareous grit, containing moulds or larox of various shells, and emitting, when rubbed with steel, a bituminous smell. The grit is cemented together by a calcareous paste. The quarries are scattered among these rocks, more or less, in every part of the isle; but those of most repute are at Kingston. At this place there is a pier, whence upwards of 6000 tons of stone, on an average, are supposed to be shipped off annually. The first stratum in these quarries is about one foot of blackish or reddish earth; then six feet of stone, not fit for exportation. Below this is the bed of good stone, ten or twelve feet deep, and beneath it flint or clay. The stratum of stone that is worked for sale lies nearly parallel with the upper surface of the island, and without much earth or rubbish on it. When the beds are cleared, the quarrymen proceed to cross-cut the large flats, which is done with wedges. The beds being cut into distinct lumps, are squared by the hammer to the largest size which it will admit; and blocks are thus formed from half a ton to six or eight tons weight. The colour of the Portland stone, or free stone as it is sometimes called, from the freedom with which it may be broken into any shape, is well known, as almost white, and as composing the materials of the most splendid erections in London, as well as in other parts of the British empire.

The general practice and management of tillage in this county is less attended to than any part of agriculture; for it appears to be the plan of the farmers to put the seed into the ground with as few ploughings as possible. The sowing of wheat is often effected with one ploughing; and symmetry and neatness are so much disregarded, that, in small pieces of land, the ploughman will vary three or four yards from a straight line. The plough used is called a *sull*, and is long, large, and heavy, with one small wheel at the side of the beam, and worked by four horses or six oxen, two abreast. In the neighbourhood of the towns, land lets for from forty to fifty shillings the acre; and, in general, arable land from twenty to thirty.

Barley is found to make the best returns; and from 10,000 to 12,000 bushels of salt are annually made in some of the towns. Flax and hemp are objects of great importance about Bridport, Bradford, and Beminster. The seed is imported from Riga, and the average crop is from fifty to sixty dozen pounds per acre, worth from four shillings and sixpence to seven shillings per dozen. It is a precarious crop, depending very much on the season; and hence the quantity cultivated has of late years been gradually diminished.

The sheep of Dorsetshire have long been celebrated. They are horned, white faced, with long small white legs, the carcass rather long and thin, the mutton fine grained and of good flavour, weighing per quarter, in wethers at three years and a half old, from sixteen to twenty pounds. Their wool is fine and short; and the breed has the peculiar property of producing lambs at any period. The stock of the county is supposed to be 800,000, of which number 150,000 are annually sold and sent out of the county. The produce of the wool yearly is estimated at 90,000 weight, of thirty-one pounds each.

The breed of horses is not particularly regarded. The oxen are principally of the red Devon breed, crossed with the Hampshire and Wiltshire; and are frequently employed in agriculture. Cows are much used for the dairy, very little account being made of their size or colour, if they produce much milk. Butter is the greatest produce, though some cheese is also manufactured.

The mackerel fishery is of considerable consequence to this county. Vast numbers are taken near Abbotsbury, and along the shore from Portland to Bridport. The season for taking them is from the middle of March till midsummer, in nets or seines. Herrings and other fish common in these seas are also taken in abundance.

The manufactures of Dorsetshire are not extensive. The principal are those of flax and hemp, in the neighbourhood of Bridport and Beminster, and also on a smaller scale in the Isle of Purbeck; of all sorts of buttons, chiefly at Blandford, and to a smaller extent at Shaftesbury; and of a sort of flannel or coarse woollen cloth, called swanskin, at Sherminster. At Stalbridge is a manufacture for spinning silk, and at Sherborne is another upon a larger scale. Some worsted stockings are made at Wimborne.

On the extended downs in the neighbourhood of Dorchester several tumuli are thrown up in all directions, proving this town to have been an important place in British times. Maiden Castle, situated on the apex of a hill about one mile south of the town, is undoubtedly the remains of an original British fortress. Nearly two miles north-west of Kingston-Hall, in the parish of Shapwicke, is a celebrated encampment called Bradbury Rings, which occupies the summit of a considerable eminence. This camp is of a circular form, with treble ramparts and ditches, having two entrances, one on the north-east and another on the western side. The circumference of the outer rampart is nearly a mile. In the parish of Lullworth

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is another British fortification, consisting of three ramparts and ditches, including an area of about five acres. It is generally called Flowers' Barrow, from the prevalence of these ancient sepulchres within its compass. Many of these barrows have been opened, and found to contain burnt bones, corroded metal, and remains of ancient warlike instruments. A barrow was opened some years ago at Stowborough, in which a body was discovered in an excavated oak trunk, wrapped in folds of skin. Between three and four miles from Corfe Castle eastward is Nine Barrow Down, an eminence which derives its name from the nine large barrows situated on it in a line. About a mile from Winterbourn Abbas is a small druidical circle, the diameter of whose area is twenty-eight feet; and the adjacent downs are much fuller of Celtic barrows than even Salisbury Plains. There is an endless field in many parts of the country for those fond of British antiquities.

The *Via Iceniana*, or Icenine Way, enters the county near Woodyates; and passing through Dorchester, takes its course to Seaton in Devonshire. There are several smaller ways proceeding from Dorchester, Winborne Minster, and some other places in the county. The Roman stations in Dorsetshire appear, from the best authorities, to have been, *Londinis*, now Lyme-Regis; *Canca-Ariza*, Charmouth; *Durnovaria*, Dorchester; *Vindogladia*, Winborne; *Clavinio*, Weymouth; *Morinio*, Wareham; and *Bolclannio*, Poole. Near Dorchester are the remains of a Roman amphitheatre, which is computed to have held nearly 13,000 spectators. A large circular entrenchment may be traced upon Woodbury Hill, supposed to have been the *Castra Stativa* of the Romans. On Hambledon Hill is another encampment; and also the remains of what has been thought to be a labyrinth. In the parish of Rampisham a beautiful tessellated pavement, about fourteen feet by ten, was discovered in 1799; and in the vale between Maiden-Newton and Frampton, at the distance of 150 yards from the river Frome, another of much larger dimensions was found in 1794. At Sturminster-Newton are the ruins of a castle, in the form of the letter D.

The remains of ancient castles are numerous in Dorsetshire. The principal are the following: Corfe, whose ruins are large, and allowed to be the noblest and grandest in the kingdom; Abbotsbury, a little north of East Bexington; Brownsea Castle, in the island of the same name; and Portland Castle.

The abbeys whose ruins may yet be discovered are those of the monastery of Benedictines at Cranborne, a part of which now forms the parish church, one of the oldest in the county; Cerne Abbey, said to be founded by St Augustin, the remains of which are not many, but interesting; Abbey Milton, whose church is now converted into a private chapel; and the monastery of Shaftesbury, the ruins of which are discernible near the mansion of Sir Thomas Arundel. Some parts of the cloister and domestic buildings of the Abbey of Sherborne are now occupied by silk-machinery; besides inconsiderable remains of several more.

The church of Fordington is partly in the Saxon style; that of Corfe is Gothic. The churches of Dorchester, Sherborne, Millbourne, St Andrew, Rapisham, Weymouth, and Shaftesbury, are all venerable buildings; but Dorsetshire cannot boast of many instances of ancient ecclesiastical buildings.

Amongst the modern erections of this county should be mentioned the new jail of the county town. It was built according to Howard's plan, under the direction of Bradburn the architect. In its external appearance it is peculiarly handsome and characteristic; and the interior possesses every convenience appropriate to its destination.

The principal noblemen and gentlemen's seats of Dor-

setshire are, Encombe, the seat of the Earl of Eldon; Grange, that of John Bond, Esq.; Moer Critchel, that of C. Sturt, Esq.; Parnham, that of Sir William Oglander, Bart.; Lullworth Castle, that of Cardinal Weld; Abbey Milton, that of Dawson Damer, Esq.; Sherborne Castle, that of the Earl of Digby; Kingston Hall, that of H. Bankes, Esq.; and Bridehead, that of E. Williams, Esq.

This county affords the following titles to different noble families; Earl of Dorchester, to the family of Carleton; Earl of Sherborne, to the family of Dutton; Earl of Shaftesbury, to that of Ashley Cooper; Viscount Bridport, to that of Hood; Duke of Portland, to that of Bentinck; Duke of Dorset, to that of Sackville; and Earl Digby, to that of Digby.

The inhabitants of this county were estimated in 1700 at 90,000, and in 1750 at 96,000. By the four decennial censuses, they appear to have been as follows: in 1801 115,319, in 1811 124,693, in 1821 144,499, and in 1831 150,400. The annual value of the real property of the county, according to the assessment of 1815, was L.698,395.

DORSIFEROUS PLANTS, among botanists, such as are of the capillary kind, without stalks, and which bear their seeds on the back side of their leaves.

DORT, or DORTRECHT, a circle in the province of Holland, in the Netherlands, divided into the four cantons of Dort, Old Beaverland, Ridderkerk, and Stryen, and containing 51,361 inhabitants.

DORT, a city of Holland, the capital of the circle of the same name, situated on the rivers Merve and Biesbosch. It is celebrated from the theological synod held there in the years 1618 and 1619. It is a place of great trade, especially in Rhine wine, timber, flax, stock-fish, and train-oil; and there are many refineries for sugar and salt, distilleries of Geneva, and mills for spinning cotton, wool, and flax. It contains 3954 houses, and 17,387 inhabitants. Long. 4. 33. 12. E. Lat. 51. 47. 52. N.

DORTMUND, a circle in the Prussian province of Westphalia, in the government of Arensburg. It extends over 180 square miles, or 51,200 acres, and comprehends five cities, one market-town, and several villages, with a population of 32,509 persons.

DORY HARBOUR, a harbour on the northern coast of Papua. At this harbour are neither fowls nor goats; but wild hogs, fish, greens, fruit, &c. Wood is plentiful, and the wild nutmeg grows in the vicinity. Long. 134. 35. E. Lat. 48. S.

DORYPHORI (from *δορυ*, spear, and *φιγω*, I bear), an appellation given to the life-guardmen of the Roman emperors. They were held in such high estimation as frequently to have the command of armies conferred on them. It was usual also for commanders-in-chief to have their doryphori or life-guard to attend them.

DOSITHEANS (*Dosithei*), an ancient sect among the Samaritans in the first century of the Christian era.

Mention is made by Origen, Epiphanius, Jerome, and various other Greek and Italian fathers, of one Dositheus, the chief of a faction among the Samaritans; but the learned are not all agreed as to the time when he lived. St Jerome, in his dialogue against the Luciferians, places him before the time of our Saviour; and in this he is followed by Drusius, who, in his answer to Serrarius, places him about the time of Sennacherib, king of Assyria. But Scaliger contends that he was posterior to our Saviour's time; and in effect Origen intimates that he must have been contemporary with the apostles, observing that this man endeavoured to persuade the Samaritans that he was the Messiah foretold by Moses.

Dositheus had many followers; and his sect subsisted at Alexandria in the time of the patriarch Eulogius, as appears from a decree of that patriarch published by Pho-

Dorsife-
rous
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Dosi-
theans.

Dosser
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Double
Employ-
ment.

tius. In this decree Eulogius accuses Dositheus of abusing the ancient patriarchs and prophets, and of attributing to himself the spirit of prophecy; makes him contemporary with Simon Magus; and accuses him of corrupting the Pentateuch in various places, as well as of composing several books directly contrary to the law of God.

Archbishop Usher conceives Dositheus to have been the author of all the changes made in the Samaritan Pentateuch, which he infers on the authority of Eulogius. But all that we can justly gather from the testimony of Eulogius is, that Dositheus corrupted the Samaritan copies since used by that sect. This corruption, however, did not pass into all the copies of the Samaritan Pentateuch now in use amongst us, which vary but little from the Jewish Pentateuch; and hence we are to understand the passage in a Samaritan chronicle, where it is said that Dosis or Dositheus altered several things in the law of Moses, in the sense here indicated. The author of that chronicle, who was a Samaritan by religion, adds, that the high priest sent several Samaritans to seize Dosis and his corrupted copy of the Pentateuch.

Epiphanius takes Dositheus to have been a Jew by birth, and to have abandoned the Jewish party for that of the Samaritans. He imagines him likewise to have been the founder of the sect of the Sadducees. But this seems inconsistent with his being later than our Saviour; and yet the Jesuit Serrarius agrees to make Dositheus the master of Sadok, from whom the Sadducees were derived.

Tertullian, in mentioning the same Dositheus, observes that he was the first who dared to reject the authority of the prophets, by denying their inspiration. But he charges as a crime peculiar to that sectary, what in reality was common to the whole sect, who never allowed any but the five books of Moses to be of divine inspiration.

DOSSER, a sort of basket to be carried on the shoulders of men. It is used in carrying the surplus earth from one part of a fortification to another where it is wanted. There are likewise small carts and wheel-barrows for the same use.

DOTIS, a market-town of Hungary, in the circle of Farther Danube. It is situated on the river Tata, near a small lake. There is an ancient castle and keep belonging to Prince Esterhazy. It contains two Catholic and one Lutheran church, a synagogue, two monasteries, 850 houses, and 8580 inhabitants. It is a place of considerable trade. Long. 18. 13. 6. E. Lat. 47. 38. 45. N.

DOUAY, an arrondissement in the department of the North, in France, extending over 450 square miles, divided into thirteen cantons, and these subdivided into 146 communes, containing 183,560 inhabitants. The city which gives its name to the arrondissement is on the river Scarpe, which is divided into several channels in passing through it. The fortifications are strong, and more easily defended, from the ease with which the environs may be inundated. It is a large but not well-built city, containing 2730 houses, and 18,460 inhabitants. It was once celebrated as the place of education of Catholic priests for the British dominions. It is now the seat of large manufactories of various kinds. Long. 2. 59. 42. E. Lat. 50. 22. 12. N.

DOUBLE; two of a sort, one corresponding to the other.

DOUBLE Children, Double Cats, &c. See MONSTER.

DOUBLE Employment, in Music, a name given by Rameau to the two different modes in which the chord of the sub-dominant may be regarded and treated, namely, as the fundamental chord of the sixth superadded, or as the chord of the great sixth, inverted from a fundamental chord of the seventh. In reality the chords carry exactly the same notes, are figured in the same manner, and are

employed upon the same chord of the tone, in such a manner that frequently we cannot discern which of the two chords the author employs, except by the assistance of the subsequent chord, which resolves it, and which is different in these different cases.

To make this distinction, we must consider the diatonic progress of the two notes which form the fifth and the sixth, and which, constituting between them the interval of a second, must one or the other constitute the dissonance of the chord. Now this progress is determined by the motion of the bass. Of these two notes, then, if the superior be the dissonance, it will rise by one gradation into the subsequent chord, the lower note will keep its place, and the higher note will be a superadded sixth. If the lower be the dissonance, it will descend into the subsequent chord, the higher will remain in its place, and the chord will be that of the great sixth.

With respect to the composer, the use which he may make of the double employment is to consider the chord in its different points of view, that he may thence know how to make his entrance to it, and his exit from it; so that having, for instance, arrived at the chord of the superadded sixth, he may resolve it as a chord of the great sixth, and reciprocally.

D'Alembert has shown that one of the chief uses of the double employment is, that we may be able to carry the diatonic succession of the gamut even to an octave, without changing the mode, at least whilst we rise; for in descending we must change it. Of this gamut, and its fundamental bass, an example will be found in Rousseau's *Musical Dictionary*. It is evident, according to the system of Rameau, that all the harmonic successions which result from it are in the same tone; for, in strictness, no other chords are there employed but three, namely, that of the tonic, that of the dominant, and that of the sub-dominant; which last, in the double employment, constitutes the seventh from the second note, and is employed upon the sixth.

With respect to what D'Alembert says in his *Elements of Music* (p. 70), and repeats in the *Encyclopédie* (article *Double Emploi*), that the chord of the seventh *re fa la ut*, though we should even regard it only as an inversion of *fa la ut re*, cannot be followed by the chord *ut mi sol ut*, Rousseau declares, "I cannot be of his opinion in this point." The proof which he gives in support of this dissent is, that the dissonance *ut* of the first cannot be resolved in the second. And this is true, since it remains in its place; but in the chord of the seventh, *re fa la ut*, inverted from the chord of the superadded sixth, *fa la ut re*, it is not the *ut*, but the *re*, which is the dissonance; and consequently it ought to be resolved in ascending upon *mi*, as it really does in the subsequent chord; so that this procedure in the bass itself is forced, which, from *re*, cannot without an error return to *ut*, but ought to ascend to *mi*, in order to resolve the dissonance.

D'Alembert afterwards shows that this chord *re fa la ut*, when preceded and followed by that of the tonic, cannot be authorized by the double employment; and this is likewise true; because, in fact, this chord, though figured with a 7, is not treated as a chord of the seventh, neither when we make our entrance to it nor our exit from it; or at least that it is not necessary to treat it as such, but simply as an inversion of the superadded sixth, of which the dissonance is the bass; in which case we ought by no means to forget that this dissonance is never prepared. Thus, though in such a transition the double employment is not in question, and though the chord of the seventh be no more than apparent, and impossible to be resolved by the rules, this does not hinder the transition from being proper and regular.

Double
Employ-
ment.

Double
Fichy
Doublet.

This inversion of the chord of the sixth superadded, which transfers the dissonance to the bass, has been censured by Rameau, who, taking it for a fundamental chord, the chord of the seventh, which results from it, rather chose to make the fundamental bass descend diatonically, and resolve one seventh by another, than to unfold this seventh by an inversion. But Rousseau has dissipated this error, and many others, in some papers which long ago passed into the hands of D'Alembert when he was composing his *Elements of Music*. In other respects, the double employment cannot be used with too much reserve, and the greatest masters are the most temperate in putting it in practice.

DOUBLE Fichy, or *Fiché*, in *Heraldry*, the denomination of a cross, when the extremity has two points; in contradistinction to *fiché*, where the extremity is sharpened away to one point.

DOUBLE Octave, in *Music*, an interval composed of fifteen notes in diatonic progression, and which, for that reason, is called a *fifteenth*. It is, says Rousseau, an interval composed of two octaves, called by the Greeks, *disdiapason*.

It deserves, however, to be remarked, that in intervals less distant and compounded, as in the *third*, the *fifth*, the *simple octave*, and so on, the lowest and highest extremes are included in the number from whence the interval takes its name. But, in the *double octave*, when termed a *fifteenth*, the simple number of which it is composed gives the name. This is by no means analogical, and may occasion some confusion. We should rather choose, therefore, to run any hazard which might occur from uniformly including all the terms of which the component intervals consist, and call the *double octave* a *sixteenth*, according to the general analogy.

DOUBLET, among lapidaries, implies a counterfeit stone, composed of two pieces of crystal, and sometimes glass softened, together with proper colours between them; so that they make the same appearance to the eye as if the whole substance of the crystal had been tinged with these colours.

The impracticability of imparting tinges to the body of crystals, while in their proper and natural state, and the softness of glass, which renders ornaments made of it greatly inferior in wear to crystal, offer inducements to the introduction of colouring the surface of crystal wrought in a proper form, in such a manner that the surfaces of two pieces so coloured being laid together, the effect may appear the same as if the whole surface of the crystal had been coloured. The crystals, and sometimes white transparent glass so treated, were called *doublets*, and at one time prevailed greatly in use, on account of the advantages with respect to wear which such doublets had, when made of crystal, over glass, and the brightness of the colours which could with certainty be given to counterfeit stones in this way, when coloured glass could not be procured, or at least not without a much greater expense. Doublets have not indeed the property which the others have, of bearing to be set transparent, as is frequently required in drops of ear-rings and other ornaments; but when mounted in rings, or used in such a manner that the sides of the pieces where the joint is made cannot be inspected, they have, when formed of crystal, the title to a preference over the coloured glass; and the art of managing them is therefore, in some degree, of the same importance with that of preparing glass for counterfeiting gems, and is properly an appendage to it, as being entirely subservient to the same intention. The manner of making doublets may be shortly described.

Let the crystal or glass be first cut by the lapidaries in the manner of a brilliant, except that, in this case, the

figure must be composed of two separate stones, or parts of stones, formed in the manner of the upper and under parts of a brilliant, if it was divided into a horizontal direction, a little lower than the middle. After the two plates of the intended stone are thus cut, and fitted so exactly that no division can appear when they are laid together, the upper part must be polished ready for setting; and then the colour must be put betwixt the two plates by the following method. Take of Venice or Cyprus turpentine two scruples; and add to it one scruple of the grains of mastich chosen perfectly pure, free from foulness, and previously powdered. Melt them together in a small silver or brass spoon, ladle, or other vessel, and add to them gradually any of the coloured substances mentioned below, but well powdered; stirring them together as the colour is put in, that they may be thoroughly commixed. Then warm the doublets to the same degree of heat as the melted mixture, paint the surface of the lower part, and put the upper one instantly upon it, pressing them to each other, but taking care that they may be conjoined in the most perfectly even manner. When the cement or paint is quite cold and set, the redundant part of it, which has been pressed out of the joint of the two pieces, should be gently scraped off the side, till there be no appearance of any colour on the outside of the doublets; and they should then be skilfully set; observing to carry the mounting over the joint, that the upper piece may be well secured from separating from the under one.

The colour of the ruby may be best imitated by mixing a fourth part of carmine with some of the finest crimson lake that can be procured. The sapphire may be counterfeited with very bright Prussian blue, mixed with a little crimson lake, to give it a cast of the purple. The Prussian blue should not be very deeply coloured, or but little of it should be used, otherwise it will give a black shade that will be injurious to the lustre of the doublets. The emerald may be well counterfeited with distilled verdigris, to which is added a little powdered aloes. But the mixture should not be strongly heated, or kept long over the fire after the verdigris has been added. The resemblance of the garnet may be made with dragon's blood; which, if it cannot be procured of sufficient brightness, may be helped by a very small quantity of carmine. The amethyst may be imitated with the mixture of some Prussian blue with the crimson lake; but the proportions can only be regulated by direction, as different parcels of the lake and Prussian blue vary extremely in the degree of strength of the colour. The yellow topazes may be counterfeited by mixing the powdered aloes with a little dragon's blood, or by good Spanish arnotto; but the colour must be very sparingly used, or the tinge will be too strong for the appearance of that stone. The chrysolite, hyacinth, vinegar garnet, aqua-marine, and other such weaker or more diluted colours, may be formed in the same manner, by lessening the proportions of the colours, or by compounding them together corresponding to the hue of the stone to be imitated; for which purpose it is proper to have an original stone, or an exact imitation of one, at hand when the mixture is made, in order to adapt the colours to the effect desired.

There is an easy method of distinguishing doublets, which is only to behold them betwixt the eye and light, in such a position that the light may pass through the upper part and corners of the stone; when it will easily be perceived that there is no colour in the body of the stone.

DOUBLETS, a game on dice within tables. The men, fifteen in number, are placed thus: Upon the six, cinque, and quatre points, there stand three men a piece; and upon the trey, deuce, and ace, only two. He who throws

Doublets.

Doubling
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Doubting.

highest has the benefit of throwing first, and what he throws he lays down, and so does the other; what the one throws and has not, the other lays down for him, but on his own account; and thus they proceed until all the men are down, and then they bear, as it is called. He who is first down bears first, and will doubtless win the game if the other throws not doublets to overtake him; which he is sure to do, since he advances or bears as many as the doublets make, namely, eight for two fours.

DOUBLING, in the military art, is the putting of two ranks or files of soldiers into one. Thus, when the word of command is *double your ranks*, the second, fourth, and sixth ranks march into the first, third, and fifth, so that the six ranks are reduced to three, and the intervals between the ranks become double what they were before.

DOUBLING, among hunters, is when a hare keeps in plain fields, and winds about in order to deceive the hounds.

DOUBLING, in the manège, is a term applied to a horse, who is said to double his reins, when he leaps several times together, in order to throw his rider. Thus it is said, "the ramingue doubles his reins, and makes pontlevis."

DOUBLING, in *Navigation*, the art of sailing round or passing beyond a cape or promontory, so that the cape or point of land separates the ship from her former situation, or lies between her and any distant observer.

DOUBLON, or DUBLOON, a Spanish and Portuguese coin, being the double of a *pistole*.

DOUBS, a department of France, formed out of the ancient province of Franche-Comté, and the lordship of Mompelgard, to which in 1816 were added the cantons of Montbeliard and Audincourt, which were taken from the department of the Upper Rhine. It is bounded on the north by the departments of the Upper Rhine and Upper Saone, on the east and south by Switzerland, and on the west by the department of Jura. It extends over 2230 square miles, and the inhabitants amount to 242,597. The divisions are four arrondissements, and the subdivisions twenty-seven cantons and 633 communes. It is generally a mountainous country; the ranges traverse it in different directions, but none exceeds 2000 feet, and they are all of calcareous formation. Between the mountains are picturesque and fertile valleys, with the exception of which the whole department may be described as an ungrateful soil, and nearly one fifth of the surface is covered with scanty woods. The land on the hills scarcely ever brings even oats to perfect ripeness; but in some parts the pasture land is good, and especially for the dairy; and many calves are bred for the neighbouring departments. The sheep are few, but the goats are numerous. There are some iron mines and iron works, and some small manufactures made from iron, besides articles made of wood, which comprise the industry of the district. The wine of late years has increased both in quality and in quantity. The capital is Besançon.

DOUBTFUL ISLAND lies in the South Pacific Ocean, in long. 141. 38. W. and lat. 17. 20. S. It was so named by Captain Cook, and was seen by the French navigator Bougainville. There is another small island of this name near the south coast of New Holland, so called by Captain Vancouver, from his uncertainty whether it was connected with the Continent. Long. 119. 49. E. Lat. 34. 23. S.

DOUBTING, the act of withholding assent from any proposition, on suspicion that we are not thoroughly apprised of its merits, or from not being able peremptorily to decide between the reasons for and against it. Doubting is distinguished by the schoolmen into two kinds, *dubi-*

tatio sterilis, and *dubitatio efficax*. The former is that where no determination ensues; and in this manner doubted the Sceptics and Academics, who withheld their assent from every thing. The latter is followed by judgment, which distinguishes truth from falsehood; and such is the doubting of the Peripatetics and the Cartesians. The *dubitatio efficax* perpetually inculcates the deceitfulness of our senses, and teaches us that we are to doubt of every one of their reports till they have been examined and confirmed by reason. On the other hand, the Epicureans teach that our senses always tell truth; and that if we deviate ever so little from them, we come within the province of doubting.

DOUDEVILLE, a market-town of the department of the Lower Seine, with 386 houses and 2984 inhabitants.

DOUDPOOR, a town of Hindustan, in the province of Gundwana, possessed by independent Goand chiefs. It is thirty-five miles south by east from Bustar. Long. 83. 10. E. Lat. 19. 36. N.

DOUPARRA, a town of Hindustan, in the south of India, and district of Commin. It is eighty-seven miles north from Cudapah. Long. 79. 4. E. Lat. 15. 43. N.

DOUGLAS, GAVIN, bishop of Dunkeld, was the third son of Archibald earl of Angus, and of Elizabeth the daughter of Robert Lord Boyd, who for some time filled the office of high chamberlain. He appears to have been born in 1474, or the ensuing year. With the place of his birth or education we are not acquainted, but we may suppose his course of study to have been suitable to his profession. Having entered into holy orders, he was collated to the rectory of Hawick;¹ and as the dormant energies of the human mind are awakened by external objects, his early residence amid the fine pastoral scenery of Teviotdale may have had a strong tendency to cherish in his imagination the seeds of genuine poetry. In the year 1509, we find him described as provost of the collegiate church of St. Giles in Edinburgh.² This preferment was in the gift of the crown: it placed him in a situation of no small dignity and emolument, and he appears to have held it with his other benefice. It was while he occupied these less elevated stations that he composed the very ingenious works which have rendered his name so conspicuous in the literary annals of his country.

His father, who is sometimes denominated the great earl of Angus, and sometimes *Bell-the-cat*, followed the standard of James the Fourth when he invaded England; but finding his prudent counsels disregarded, he excused himself on account of his advanced age, and withdrew from the army. His two eldest sons, George and William, together with about two hundred gentlemen of the name of Douglas, perished in the fatal battle of Flodden-field. This calamity to the nation in general, and to his own family in particular, made so deep an impression on his heart, that having retired to St Mains, a religious house in Galloway, he died there within the space of twelve months.³ His title and estates descended to his grandson Archibald, a young nobleman whose personal attractions were so unrivalled that he speedily obtained the tender regard of the widowed queen, and their nuptials were solemnized before she had completed the year of mourning. This precipitate match, which had been concluded without the concurrence of the principal nobility, excited general indignation: the queen was no longer willingly acknowledged as regent; the pre-eminence of her husband rendered him odious in the eyes of the more powerful subjects; and the house of Douglas was involved in persecutions which this resentful spirit of jealousy excited.

||
Douglas.

¹ Alexandri Myln Vitæ Episcoporum Dunkeldensium, p. 72. Edinb. 1823, 4to.

² Keith's Catalogue of the Scottish Bishops, p. 93.

³ Hume's History of the Houses of Douglas and Angus, p. 235. Edinb. 1644, fol.

Douglas.

Among those who perished at Floddon were the archbishop of St Andrews, the bishop of the Isles, the abbot of Kilwinning, the abbot of Inchaffray, and other warlike sons of the church. The archbishop of St Andrews, Alexander Stewart, who was the king's natural son, and a young man of very promising talents, had likewise held the abbacies of Aberbrothock and Dunfermline, together with the priory of Coldingham. In a letter addressed to Pope Leo the Tenth, the queen, after extolling Gavin Douglas as second to none in learning and virtue, earnestly requested that he might be secured in the possession of the abbacy of Aberbrothock, till his singular merit should be rewarded by some more ample preferment.¹ After the death of the late primate, William Elphinstone, bishop of Aberdeen, had been nominated to the vacant see; but his modesty or infirmities induced him to decline this splendid offer, and the queen afterwards attempted to elevate Douglas to the primacy. Confiding in the royal nomination, and in the influence of his own family, he took possession of the archiepiscopal palace; but his claims were disputed by two powerful rivals, John Hepburn, prior of St Andrews, and Andrew Foreman, bishop of Moray in Scotland, and archbishop of Bourges in France. Hepburn having prevailed upon the canons to elect him to the see, laid siege to the castle, and after meeting with some resistance, expelled the retainers of his competitor; nor did the earl of Angus, with a party of two hundred horse, succeed in his attempt to recover the possession of this strong hold.² In the mean time, Foreman, who was a person of great influence, found means to obtain from Rome a grant of the archbishopric of St Andrews, and the other preferments which had been held by the late primate.³ Douglas, actuated by a decent spirit of moderation, resolved to abandon the pursuit of this high object of ecclesiastical ambition; but the other competitors seem to have been alike insensible to motives of private virtue and of public decorum. Foreman being afraid to publish the papal bulls, prevailed upon Lord Hume, by bestowing on his brother the priory of Coldingham, to undertake the support of his cause; and this border chieftain enabled him to appear at Edinburgh, attended by ten thousand men in arms. Having performed the necessary ceremony, they hastened to St Andrews in order to complete their pious task, but they found the prior sufficiently prepared for their reception: in the castle and in the cathedral he had placed so considerable a garrison, that Foreman was unwilling to hazard an attack, and deemed it more prudent to adjust their claims by an amicable negotiation; it was finally stipulated that he should be put in quiet possession of the primacy, that Hepburn should receive a yearly pension from the bishopric of Moray, and should retain such rents as he had already levied from the archbishopric of St Andrews.⁴

From this negotiation Douglas derived no advantage; and, to complete the measure of his disappointments, the abbacy of Aberbrothock, which he had regarded as secure, was transferred to James Beaton, archbishop of Glasgow, and chancellor of the kingdom. The death of George Brown, bishop of Dunkeld, which occurred in the

month of January 1515, presented him with new prospects, and exposed him to new mortifications. The queen nominated him to the vacant see, and, as is supposed, by the intervention of her brother the king of England, obtained a papal bull in his favour. But, in the mean time, the earl of Athole had induced the chapter to postulate his brother Andrew Stewart, prebendary of Craig, who had not yet taken subdeacon's orders.⁵ The enemies of the queen did not neglect this opportunity of disgracing an individual so nearly allied to her husband: Douglas was cited before the competent judges, and was accused of having violated the laws, by procuring bulls from Rome. Such practices had indeed been prohibited by several statutes, but these had very seldom been enforced. Of this offence he was however convicted; and being committed to the charge of his former rival Hepburn, he was successively confined in the castles of Edinburgh, St Andrews, and Dunbar, and again in that of Edinburgh. Before the period of his trial, the queen's party had almost entirely lost its influence: the duke of Albany, who was the grandson of James the Second, and the cousin of the late king, arrived from France on the 10th of May, and within the space of about two months was declared regent of the kingdom. A compromise at length took place between the two parties: Douglas obtained his liberty after an imprisonment of more than twelve months; and his claim to the bishopric was secured by Beaton's mediation with the new regent. He was consecrated at Glasgow by the same prelate, who defrayed the expenses attending this ceremony; and having paid a visit to the metropolitan city of St Andrews, he proceeded to Dunkeld, where the clergy and laity testified the utmost joy at the arrival of so noble, learned, and pious a bishop. The bulls having with the usual solemnities been read at the high altar, he retired to the residence of the dean, George Hepburn, by whom he was suitably entertained. The episcopal palace was still occupied by the retainers of Stewart; and the bishop finding next day that they had likewise seized the tower of the cathedral, was obliged to perform divine service at the deanery. In the afternoon he held a consultation with the nobility, gentry, and clergy, by whom he was attended; but their deliberations were speedily interrupted by the intelligence that Stewart had taken up arms, and was advancing to support his adherents; and at the same time they were alarmed by the commencement of a fire from the palace and the cathedral. Lord Ogilvy, with the eldest son of the earl of Crawford, and many other friends, including a considerable number of ecclesiastics, with the dean among the rest, immediately began to prepare for action; and messengers having been dispatched to the neighbouring districts, his party was next day strengthened by the arrival of a formidable reinforcement of armed men. Stewart, who did not find himself strong enough to hazard an attack, retired into the woods. His retainers, who garrisoned the palace and the cathedral, were now summoned to surrender, under the pain of excommunication; and on their refusing to obey this summons, the bishop's servants, led by a valiant prebendary, and by James Carmichael,

Douglas.

¹ *Epistolæ Regum Scotorum*, vol. i. p. 183. Edinb. 1722-4, 2 tom. 8vo.

² *Buchanani Rerum Scotticarum Hist.* p. 256. Pinkerton's *Hist. of Scotland*, vol. ii. p. 124.

³ *Epistolæ Regum Scotorum*, vol. i. p. 269.

⁴ *Buchanan*. p. 257. Lindsay's *Cronicles of Scotland*, vol. ii. p. 291.

⁵ It may not be unnecessary to remark, that in the popish church there are seven orders, namely, those of porter, lector, exorcist, acolyte, subdeacon, deacon, and priest; and that no person can regularly be elected a bishop, unless he has at least taken subdeacon's orders. Although he cannot be elected, he may however be postulated by the chapter; and if this postulation is admitted by the pope, he is then considered as elected and confirmed. "Postulatio est ejus, qui eligi non potest, in prælatum concors capituli facta petitio." (*Lancelotti Institutiones Juris Canonici*, lib. ii. tit. viii.) There are other canonical impediments, which we need not enumerate; for Stewart's disqualification is particularly specified by Myln.

Douglas. took possession of the cathedral. Intimidated by this event, those who occupied the palace requested that a truce might be granted, and the sentence of excommunication delayed for a few hours; but when the stipulated time had elapsed, they still refused to surrender. The interference of the regent at length enabled Douglas to take possession of his palace without the effusion of blood; a circumstance, as one of his biographers has remarked, which "was certainly very acceptable to the good bishop; who in all the actions of his life discovered a gentle and merciful disposition, regulating the warlike and heroic spirit of his family by the excellent laws of the Christian religion."¹ After these events, Stewart hastened to the court, accompanied by his brother the earl; and Douglas having likewise made his appearance, their respective claims were taken into consideration by the regent and council. It was finally agreed that Stewart should relinquish his pretensions to the see of Dunkeld, but should retain such rents as he had already levied, and should be confirmed in the possession of the two benefices of Alyth and Cargill, under the condition of paying the bishop a certain annual contribution in grain.² Although Douglas had so recently been punished for soliciting bulls from Rome, yet the regent did not scruple to apply to the pope for a ratification of this agreement: in a letter dated on the 28th of September 1516, he entreated his holiness that all informalities might be removed, and the stipulations rendered valid by his sanction.³

Having at length been installed in his cathedral, he was speedily called from the discharge of his episcopal functions. During the ensuing year, an ambassador arrived from France, with a proposition for the renewal of the ancient league between the two kingdoms; and it was thought expedient that the duke of Albany should himself repair to Paris, accompanied by Bishop Douglas, and by Patrick Panter, chancellor of Dunkeld, and secretary of state. The negociation having been brought to a satisfactory conclusion, the bishop was employed to convey the earliest intelligence to Scotland.⁴ His professional duties seem again to have been interrupted during some part of the year 1518: in the British Museum there is an original letter, signed by the earl of Angus and others, and recommending him to the English king as a proper person to transact certain affairs in which they were concerned.⁵ Though thus exposed to occasional distractions, he yet presided over his diocese with exemplary piety. The various troubles in which he was formerly involved had not merely prevented him from accumulating riches, but had even encumbered him with debts; yet the benevolence of his disposition prompted him to perform many acts of charity and munificence.⁶ The revenues of this see are represented as ample,⁷ and he was again so fortunate as to fix his residence in a delightful part of the country: the situation of Dunkeld, which no intelligent lover of our early literature can visit without recollecting the name of Douglas, has a romantic beauty of which it is difficult to convey an adequate idea.

When the duke of Albany was preparing to quit the kingdom, he delegated his authority to the archbishops of

St Andrews and Glasgow, and the earls of Arran, Angus, Argyle, and Huntley: but the predominating power of Angus excited the apprehensions or the jealousy of his colleagues; and they resolved to unite their strength with the view of circumscribing the influence of so formidable a rival. On the 29th of April 1520, Arran with many others of the nobility assembled at Edinburgh in the house of Archbishop Beaton: they formed the resolution of instantly seizing the person of Angus, whose power, they pretended, was so exorbitant that, while he continued at liberty, his fellow-subjects could enjoy no security. Aware of their hostile intentions, he requested his uncle the bishop of Dunkeld to mitigate their resentment, and persuade them to adopt a more lawful method of redress. He accordingly addressed himself to the archbishop, whom he found in the church belonging to the monastery of the black friars, and entreated him to act the part of a peacemaker: the crafty and turbulent prelate protested that he was at once ignorant of their designs, and unable to prevent them from being carried into execution; and to confirm this averment, he made a solemn appeal to his conscience, but having too forcibly applied his hand to his breast, he discovered to his indignant companion, that his sacred habit concealed a coat of mail. "My Lord," exclaimed the bishop, "I perceive your conscience is not good, for I hear it *clattering*," that is, telling tales. He next accosted Sir Patrick Hamilton, requesting him to interpose with his brother the earl of Arran: this gentleman was inclined to peaceable measures, when the earl's natural son Sir James, a man of a ferocious disposition, rudely upbraided him with cowardice. This charge he repelled with indignation; and having drawn his sword, he rushed furiously into the street, where the earl of Angus had stationed a numerous body of his retainers: perceiving him advance before the other assailants, the earl called aloud to his followers to save Sir Patrick Hamilton's life; but in the heat of battle it is difficult to spare those who are eager to destroy, and he was speedily slain, together with the eldest son of the earl of Eglintoun. The encounter, which was long and fierce, was at length decided by the interference of some of the citizens, who were favourably disposed to the queen, and therefore espoused the cause of her husband. Seventy-two of his antagonists perished in the battle. During this scene of disgraceful violence, the bishop of Dunkeld had retired to his chamber, and spent the anxious interval in a manner suitable to the profession; but when the contest was decided, he hastened to prevent the wanton effusion of blood. The archbishop, who appears to have been personally engaged, had taken refuge behind the altar of Black-friars church, and the rocket was already torn from his shoulders, when the interposition of Douglas saved his life.⁸

The duke of Albany, after an absence of upwards of four years, returned to Scotland in 1521; and one of his earliest measures was to reduce the inordinate power of the Douglasses. Angus and his principal adherents, having been summoned to answer for their violent proceedings, fled for refuge to the Kirk of Steill. The bishop of Dunkeld was dispatched to London as their accredited agent,

¹ Sage's Life of Douglas, p. 7.

² Myln, Vitæ Episcoporum Dunkeldensium, p. 75.

³ Epistolæ Regum Scotorum, vol. i. p. 222.

⁴ Leslæus de Rebus gestis Scotorum, p. 385-9. Pinkerton's Hist. of Scotland, vol. ii. p. 165.

⁵ Pinkerton's List of the Scottish Poets, p. xcv.

⁶ Winton's Cronykil of Scotland, vol. i. p. 167. Pinkerton's Hist. of Scotland, vol. ii. p. 127. The bishopric of Dunkeld was reckoned the third see in the kingdom.

⁷ Buchanan, p. 261. Lindsay's Chronicles of Scotland, vol. ii. p. 285. Hume's Hist. of the Houses of Douglas and Angus, p. 245.—Lindsay refers this event to the year 1515, but other historians, with greater probability, add five years to the number. The encounter was long remembered in Edinburgh by the name of *Cleanse the Causey*.

⁸ Myln, p. 75.

Douglas. and was instructed to represent their safety as necessarily connected with that of their young sovereign.¹ At the court of Henry the Eighth, where his poetical talents had probably found many admirers, he experienced a gracious reception; and the king is said to have provided for his maintenance by the grant of a liberal pension.² He now contracted a friendship with Polydore Virgil, who was engaged in composing a history of England. The recent publication of Mair's history of Scotland, in which he ventured to expose the Egyptian fables of his predecessors, had excited the indignation of such of his countrymen as delighted to trace their origin to the daughter of Pharaoh. Douglas was studious to warn his Italian friend against the opinions of this worthy doctor of the Sorbonne;³ and presented him with a brief commentary, in which he pursued the fabulous line of our ancestry from Athens to Scotland; nor was a poet to be easily induced to relinquish so fine a tissue of romantic narrative. This tract, which was probably written in Latin, seems to have shared the common fate of the manuscripts entrusted to Polydore; who, in order to secure the errors of his work from detection, is said to have destroyed many valuable monuments of antiquity.⁴ Vossius has stated that Douglas wrote a history of Scotland, consisting of several books;⁵ but Bishop Bale, to whose authority he refers, only mentions a single book;⁶ and it is evident that the historical work to which both these writers and Dempster⁷ allude, is merely the brief commentary quoted by Polydore Virgil.

While the accomplished prelate was thus employed in England, his enemies were not inactive in Scotland. His mission to the English king furnished a sufficient pretext for accusing him of treason: on the 21st of February 1522 he was declared a traitor, and the revenues of his see were placed in a state of sequestration; the king's subjects were prohibited, under the pain of treason, from affording him any pecuniary assistance, or maintaining with him any correspondence either by letters or messages. An account of these proceedings was transmitted to the pope, accom-

panied with a remonstrance against the nomination or recommendation of the traitor Gavin Douglas to the archbishopric of St Andrews and the abbacy of Dunfermline, or to either of those preferments.⁸ The extent of his influence had manifestly excited the alarm of Beaton, who was determined at all hazards to secure these ample prelates, recently become vacant by the death of Foreman. Nor were these the only expedients to which he resorted: as chancellor of the kingdom, he addressed a letter to the king of Denmark, entreating him to represent Douglas to the sovereign pontiff as a person altogether unworthy of his favour and protection.⁹ Beaton became archbishop of St Andrews, and Douglas died in exile. He had been cited to appear at Rome, and, according to his own declaration, he intended to obey the summons;¹⁰ but in the course of the same year, and before he began to decline from the vigour of manhood, he was seized with the plague, and speedily fell a victim to its dreadful contagion.¹¹ He died at London in 1522, and was interred in the Savoy church, on the left side of Thomas Halsay, bishop of Leighlin in Ireland; whose monument also contained a short inscription of his name and addition.¹² The character which he left behind him was that of a "man learned, wise, and given to all vertue and goodness."¹³ With the splendour of his birth and the dignity of his person he united many accomplishments and many virtues. Although he lived in an age of lawless violence, and was connected with a powerful and turbulent family, he was uniformly distinguished by the moderation of his conduct.¹⁴ The fruits produced by the celibacy of the Romish clergy are sufficiently known: the bishop of Dunkeld left a natural daughter, from whom Semple of Foulwood derived his lineage.¹⁵ Transgressions of this nature were so common, that they must almost have ceased to be regarded as criminal: Patrick Hepburn, bishop of Moray, had two sons legitimated in one day, and five daughters in another.

It is the secular learning of Bishop Douglas that has chiefly attracted the attention of posterity; but Myln,

¹ In the British Museum, Calig. B. vi. 223, there is an original paper, dated "at the Kirk of the Steill," 14 December 1521, and containing "Instructions and Commissioun for my Lord of Dunkeld, to be schawin vnto the Kyngis Grace of Ingland, on the behalf of my Lord of Anguss, his kyn and frendis, Lord Hwme, Lord Sommervell, thar kyn and frendis." This document states that, for the fulfilment of the articles mutually agreed upon, the said lords are bodily sworn upon the gospels, "befor a reuerend fader, Gawin Bischop of Dunkeld, and Thomas Lord Dacre."

² Holinshed's Chronicles, vol. iii. p. 872.

³ Polydori Virgilii Anglica Historia, p. 52. edit. Basil. 1556, fol.

⁴ Peacham's Compleat Gentleman, p. 51. edit. Lond. 1634, 4to.—"He is said to have borrowed books out of the publick library at Oxford, without taking any care to restore them: upon which the university (as they had good reason) declined lending any more, till forced to it by a mandate which he made a shift to procure from the king. In other places he likewise pillaged the libraries at his pleasure; and, at last, sent over a whole ship-load of manuscripts to Rome." (Nicolson's English Historical Library, p. 70.)

⁵ Vossius de Historicis Latinis, p. 636.

⁶ Dempsteri Hist. Ecclesiast. Gent. Scotor. p. 221.

⁷ Epistolæ Regum Scotorum, vol. i. p. 328.

⁸ Ibid. vol. p. 333.

⁹ Pinkerton's Hist. of Scotland, vol. ii. p. 194.—In a letter from the bishop of Bath to Cardinal Wolsey, dated at Rome on the 19th of March, the following passage occurs: "The bishope of Dunkell his servant is come; and I doo the best I can to helpe and assist hym in his masters causes, accordyng your grace is commandment." (H. Ellis's Original Letters, second series, vol. i. p. 316.) See likewise p. 323. The earl of Morton was accused of treason, and, among other grounds, "for the tresonable counsaile, help, supportacioun, and assistance, gevin to Gawyne bischop of Dunkeld, in his tresonable passing in Ingland:" but an act of parliament, passed in 1524, declared the charge against him, "in all the punctis it contenit, vane, vntrew, and had na veritie." (Acts of the Parliaments of Scotland, vol. ii. p. 290.)

¹⁰ Polydori Virgilii Anglica Historia, p. 53.—According to Hume's calculation, he had reached the forty-sixth year of his age in 1520. His testament may be found in the appendix to Mr Riddell's Reply to the Misstatements of Dr Hamilton, in his late *Memoirs of the House of Hamilton corrected*. Edinb. 1828, 4to. On the 19th of September 1522, it was proved by one of the executors, Matthew Geddes, vicar of Tippermuir, his chaplain. The inventory of the bishop's goods was taken "apud hospitium Domini Dacris." In the British Museum, Calig. B. i. 27, there is an original letter from Douglas to Lord Dacre, in which he says, "our houssys ar of the auld allyat." Mr Riddell has suggested that the testament makes no allusion to the pension mentioned by Holinshed; and that "the bishop seems to have been reduced to straits, as he is obliged to pawn some of his silver plate." But as his mission to England was considered as treasonable, he had an obvious reason for avoiding the mention of an English pension; and in most cases there is no great difficulty in supposing a man's expenses to exceed his income.

¹¹ Weever's Ancient Funeral Monuments, p. 446.

¹² Spotswood's Hist. of the Church of Scotland, p. 101.—This historian states that "he died of the plague at London in Savoy house."

¹³ Buchanani Rerum Scoticarum Historia, p. 262.

¹⁴ Hume's Hist. of the Houses of Douglas and Angus, p. 220.

Douglas, who was one of the canons of his cathedral, represents him as eminently skilled in divinity and the canon law. He was perhaps the most learned of the early Scottish poets. Among the ancient poets, his favourites were apparently Virgil and Ovid; among the Christian fathers, his favourite was St Augustin, whom he denominates the chief of clerks. Of the Latin language his knowledge was certainly extensive; and as he states that Lord Sinclair had requested him to translate Homer, we may venture to infer that he was not unacquainted with Greek. It is highly probable that he had completed his education on the continent, and had thus given his studies a more elegant and classical direction. Nor were his talents less conspicuous than his learning. In all his writings he evinces an excursive fancy, with much of the fervour of genius. His allegorical sketches are efforts of no common ingenuity; but what chiefly renders his works interesting is the frequent occurrence of those picturesque and characteristic touches, which can only be produced by a man capable of accurate observation and original thinking. He exhibits perpetual vestiges of a prolific and even exuberant imagination, and his very faults are those of superabundance rather than deficiency. In his descriptions, which are often admirable, he occasionally distracts the attention by a multiplicity of objects, nor is he sufficiently careful to represent each new circumstance in a definite and appropriate manner. His style is copious and impetuous, but it cannot be commended for its purity. In his translation of Virgil he professes to be scrupulous in rejecting Anglicisms, and indeed his diction is often remote from that of the English poets: but he has imported many exotic terms from another quarter; his familiarity with the Latin language betrays itself in almost every page of his writings. His verses, though less smooth and elegant than those of Dunbar, are not unskillfully constructed.

Of Douglas's original compositions the longest is the *Palice of Honour*;¹ an allegorical poem which displays much versatility of fancy and a ready command of striking imagery. Still however it is to be considered as a Gothic structure, and as exhibiting many of the peculiarities which belong to that order: ancient and modern usages, classical and Christian subjects, are almost constantly blended together; and a nymph of Calliope's train expounds the scheme of human redemption. This poem appears to have been composed in 1501, when the author was twenty-six or twenty-seven years of age. It has been surmized that Douglas's work is probably founded on the *Sejour d'Honneur* of Octavien de St Gelais.² The titles have indeed an obvious resemblance to each other, but there is little or no affinity in the plan and execution of the two poems. The successive appearance of the different courts described in the *Palice of Honour*, may possibly remind some readers of the *Triumphs of Petrarch*,

in which various shadowy trains succeed each other in a somewhat similar manner; but notwithstanding these different suggestions, Douglas's poem must still be regarded as entitled to the praise which belongs to an original design.

King Hart, another allegorical poem of the same author, exhibits a very ingenious adumbration of the progress of human life.³ It is a singular composition, and may remind the reader of Phineas Fletcher's *Purple Island*; a work which furnishes a striking example of the misapplication of fine poetical talents. From the occurrence of several incorrect passages, it has been supposed to be one of Douglas's earliest performances. Incorrect passages we may expect to find in all the vernacular poetry of that age; and the versification appears to us superior to that of the *Palice of Honour*. As he has not enumerated it among his early works, we may perhaps venture to conclude that it was written after his translation of Virgil. The heart, being the fountain of vital motion, is here personified as man himself, and is conducted through a great variety of adventures.

But the most remarkable of Douglas's works is perhaps his translation of the *Æneid*.⁴ In the original poems which accompany it, he has fortunately specified the origin and progress of this undertaking: he there informs us that it was begun at the request of his cousin Lord Sinclair, whom he represents as a zealous collector of books, and protector of science and literature; and that it was the labour of only sixteen months, being completed on the 22d day of July 1513, about twelve years after he had composed the *Palice of Honour*. This task must apparently be understood to comprehend, not merely a version of Virgil's twelve books, but likewise of the supplementary book of Mapheus Vegius, together with the original poems which he has interspersed in the volume. Whether we consider the state of British literature at that period, or the rapidity with which he executed so extensive a work, it is impossible to withhold from this version a large share of our approbation. In either of the sister languages, few translations of classical authors had hitherto been attempted. Even in England, it has been remarked, no metrical version of a classic had yet appeared; except of Boethius, who scarcely merits that appellation.⁵ On the destruction of Troy, Caxton had published a kind of prose romance, which he professes to have translated from the French; and the English reader was taught to consider this motley composition as a version of the *Æneid*. Douglas bestows severe castigation on Caxton for his perversion of the classical story; and affirms that his work no more resembles Virgil than the devil resembles St Austin. He has however fallen into one error which he exposes in his precursor; proper names are so completely disfigured in his translation, that they cannot be recognized without some degree of difficulty. In various in-

¹ The *Palis of Honoure*, compeled by Gawayne Dowglas, Bysshope of Dunkyll. Imprinted at London in Fletstret, at the sygne of the Rose garland, by Wyllyam Copland. 4to. This edition, which is without a date, was probably printed about the same time with the author's translation of Virgil. They are uniformly printed, and both title-pages have the same ornamental border. Another early edition bears the following title: "Heir beginnis ane treatise callit the *Palice of Honovr*, compylit be M. Gawine Dowglas, Bischop of Dunkeld. Imprintit at Edinburgh be Iohne Ros for Henrie Charteris, anno 1579. *Cum Privilegio Regali*. 4to. The epistle "To the Reidar" begins thus: "Quhen we had sene and considderit the diuers impressiones befor imprintit of this notabill werk, to haue bene altogidder faultie and corrupt, not onlie that quhilk hes bene imprintit at London, bot also the copyis set furth of auld amangis our selfis." Copland's edition is however the earliest which bibliographers have been able to trace. The Edinburgh edition has lately been reprinted for the Bannatyne Club. Edinb. 1827, 4to.

² *Le Sejour d'Honneur*, composé par reuerend Pere en Dieu Messire Octouien de Sainct Gelaiz, Euesque d'Angoulesme, nouvellement imprimé. Paris, 1519, 8vo.

³ *King Hart* was first printed in Mr Pinkerton's *Ancient Scottish Poems*, vol. i. Lond. 1788, 2 vols. 8vo.

⁴ The xiii. bukes of *Eneados* of the famose poete Virgill, translatet out of Latyne verses into Scottissh metir, bi the Reuerend Father in God, Mayster Gawin Douglas, Bishop of Dunkel, & vnkil to the Erle of Angus: euey buke hauing hys perticular Prologe. Imprinted at London, 1553, 4to. Another edition, with a life of the translator by Sage, and a glossary by Ruddiman, appeared after a long interval. Edinb. 1710, fol.

⁵ Warton's *Hist. of English Poetry*, vol. iii. p. 112.

Douglas. stances, he has been guilty of modernizing the notions of his original: the Sibyl, for example, is converted into a nun, and admonishes Æneas, the Trojan baron, to persist in counting his beads.

Douglas's translation of Virgil is certainly executed with no mean ability; it is the effort of a bold and energetic writer, whose knowledge of the original language,¹ and prompt command of a copious and variegated phraseology, qualified him for the performance of so arduous a task. It is indeed to be regretted that he did not devote a much longer period to this undertaking: he might thus have been enabled to render his versification more terse and finished; but the work, in its present state, is a singular monument of his genius and industry. One of his principal objects was to write in plain and intelligible language, so that his favourite poet might be readily understood by his countrymen; and by keeping this object constantly in view, he has frequently attained to less elevation of style than might have been expected. His translation possesses one merit which he probably did not contemplate: as a version of a well-known classic, it presents an ample fund of philological information; and Ruddiman's excellent glossary has long recommended it to all those who have paid any particular attention to the etymology of the Scottish language. The felicity of this translation has been very warmly commended by another Scottish prelate, Dr Lesley, the celebrated bishop of Ross; who, in enumerating its various excellencies, has stated that it always renders one verse by another. But this regularity of correspondence, for which it has likewise been praised by Dempster, must not be too literally understood; and it may be proper to recollect that the verses of the two poets, although they might be equal in number, could not be equal in length, as a hexameter line may consist of seventeen, and cannot consist of fewer than thirteen syllables.

The bishop of Dunkeld's version of the Æneid seems to have suggested a similar plan to the earl of Surrey, who translated the second and fourth books into English. In this translation he has exhibited the earliest specimen of blank verse that occurs in the history of English poetry. Dr Nott has remarked that "we meet with so many expressions which Surrey has evidently borrowed, with so many lines adopted with hardly any other alteration than that which the difference of the dialect, and the measure made necessary, and so many taken without any alteration at all, that all doubt ceases. It becomes a matter of certainty that Surrey must have read and studied the Scottish translation before he began his own."² This assertion he has verified by a long series of parallel passages, which it is impossible to read without acquiescing in his opinion.

The several books of Douglas's translation are introduced by prologues, which, in the opinion of Warton, are often highly poetical, and shew that his proper walk was original poetry. They have likewise received warm commendation from Hume of Godscroft, who was himself a scholar and a poet. "In his prologues before every book," he remarks, "where he hath his liberty, he sheweth a natural and ample vein of poesy, so pure, pleasant, and judicious, that I believe there is none that hath written before or since, but cometh short of him. And, in my

opinion, there is not such a piece to be found as his prologue to the eighth book, beginning *Of drevilling and dreams*, &c. at least in our language."

These are the only works of Bishop Douglas with which we are now acquainted. On concluding his translation of Virgil, he avowed a resolution to devote his future days to the service of the commonwealth and the glory of God. The earliest of his poetical performances appears to have been a translation of Ovid *De Remedio Amoris*; but of this translation no copy is known to be extant.

Lo thus, followand the floure of poetry,
The battellis and the man translate haue I,
Quhilk zore ago in myne undantit zouth,
Unfructuous idilnes fleand, as I couth,
Of Ovideis Lufe the Remede did translate,
And syne of hie Honour the Palice wrate.

Bale mentions another of his compositions under the title of "Aureæ Narrationes;" which Sage supposes to be the short commentary noticed in the concluding address to Lord Sinclair:

I haue also ane schorte commend compyld,
To expone strange historiis and termes wylde.

This comment, as the same biographer conjectures, may have been merely a brief explanation of the classical mythology. If we may rely on the authority of Bale and Dempster, he likewise composed comedies; but both these writers are apt to multiply books as well as authors. Another biographer is inclined to suppose that he may have written the *Flowers of the Forest*, a song which displays no small portion of pathetic simplicity. "It may be conjectured," says Mr Scott, "that he was the author of that celebrated elegaic song, which describes the devastation occasioned by the battle of Flowdon, in that part of the country with which he had long been well acquainted."³ It was published by Mr Lambe in the year 1774, and is described by him as an old Scottish song;⁴ and Mr Ritson, who thought it "as sweet and natural a piece of elegaic poetry as any language can boast," had no hesitation in believing it to have been composed immediately after the battle of Floddon-field;⁵ a decision which sufficiently evinces that, notwithstanding his confidence in his own judgment, and his undisguised contempt for almost all his predecessors, his critical opinions on such subjects were very far from being infallible. According to a more authentic account, the tune and two detached verses of this song are ancient; and all the others were composed by a lady connected with the county of Roxburgh.⁶ The language and versification are evidently of a more recent date than the year 1513; nor could such a composition be safely referred to any period preceding the last century. (x.)

DOUGLAS, a town of Scotland, in Lanarkshire, lying on the south side of the Douglas water, on the road between Edinburgh and Ayr. It is a place of great antiquity, and possesses at present one or two manufactories of cotton; but it is chiefly celebrated for a great annual fair which is held here in the church-yard. The population of the town and parish amounted in 1821 to 2195, and in 1831 to 2542.

DOUGLAS, a sea-port town of the Isle of Man, situated on the south-eastern shore, and occupying the banks of

¹ See however the remarks of Francis Junius, which are contained in a letter published in "The Life, Diary, and Correspondence of Sir William Dugdale," p. 383. Lond. 1827, 4to.

² Nott's Dissertation on the State of English Poetry before the Sixteenth Century, p. cciv.

³ J. Scott's Life of Douglas (p. xxvi.), prefixed to his Select Works. Perth, 1787, 12mo.

⁴ History of the Battle of Floddon, with notes by Robert Lambe, Vicar of Norham upon Tweed, app. p. 129. Berwick upon Tweed, 1774, 12mo.

⁵ Ritson's Ancient Songs, p. 117.

⁶ Scott's Minstrelsy of the Scottish Border, vol. iii. p. 127.—This lady is elsewhere said to have been Jane Elliot, who was born at Minto in the year 1726.

Douleia
||
Douw.

two small streams. The streets, though irregular, possess some good houses. This is the principal town of the island. It has a safe and spacious harbour, which is defended by a strong fort. Long. 4. 44. W. Lat. 58. 52. N.

DOULEIA (*Δουλειά*), among the Athenians, a kind of punishment by which the criminal was reduced to the condition of a slave. It was never inflicted upon any except the *ατιμοι*, *sojourners* and *freed servants*.

DOULENS, an arrondissement of the department of the Somme, in France, extending over 310 square miles, and divided into four cantons and eighty-nine communes, containing 52,626 inhabitants. The capital is a town of the same name, situated at the junction of the two rivers the Authie and the Grouche. It contains 460 houses and 1323 inhabitants.

DOUNE, a village of Scotland; in the southern part of Perthshire, pleasantly situated on the northern bank of the Teith. It consists of three streets radiating from a centre, where stands the market-cross. Its general appearance was much improved in 1826 by the erection of a parish church in the Gothic style, with a handsome tower. In the immediate vicinity is an extensive cotton manufactory.

DOUR, a town in the circle of Mons, and province of Hennegau, in the Netherlands. Near to it are some very extensive coal mines. The inhabitants amount to 4549.

DOURDAN, a market-town of France, in the department of the Seine and Oise, situated on an elevation overlooking the river Orge, with 450 houses and 2592 inhabitants.

DOUW, GERHARD, a celebrated painter, was born at Leyden in 1613, and received his first instruction in drawing and design from Bartholomew Dolendo, an engraver, and also from Peter Kouwhoorn, a painter on glass. At the age of fifteen he became a disciple of Rembrandt; and in that famous school he continued for three years, at the expiration of which he found himself qualified to study nature, the most unerring director.

From Rembrandt he learned the true principles of colouring, and obtained a complete knowledge of the *chiaroscuro*; but to that knowledge he added a delicacy of pencil, and a patience in working up his colours to the highest degree of neatness, superior to any other master. He therefore was more pleased with those pictures of Rembrandt which were painted in his youth than with those by which he was distinguished in his more advanced age; because the first seemed finished with more care and attention, the latter with more boldness, freedom, and negligence, which was quite opposite to the taste of Douw. But although his manner appears so different from that of his master, yet it was to Rembrandt alone that he owed that excellence in colouring by which he triumphed over all the artists of his own country.

His pictures are usually of a small size, with figures so exquisitely touched, so transparent, so wonderfully delicate, as to excite astonishment as well as pleasure. He designed every object after nature, and with an exactness so singular, that each object appears as perfect as nature itself, in respect to colour, freshness, and force. His general manner of painting portraits was by the aid of a concave mirror, and sometimes by looking at the object through a frame with many exact squares of fine silk. But the latter custom is disused, as the eye of a good artist seems a more competent rule, though the use of the former is still practised by painters in miniature.

It is almost incredible what sums have been given and are given at this day for the pictures of Douw, even in his own country, as also in Italy and every polite part of Europe; for he was exceedingly curious in finishing them, and patiently assiduous beyond example. Of that pa-

Dove
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tience Sandrart gives a very strong proof in a circumstance which he mentions relative to this artist. Having once, in company with Bamboccio, visited Gerhard Douw, they could not forbear admiring the prodigious neatness of a picture which he was then painting, and in particular noticed a broom, at the same time expressing their surprise at the excessive neatness of the finishing of that minute object; upon which Douw told them he would spend three days more in working on that broom before he should account it entirely complete. In a family picture of Mrs Spiering, the same author observes, that the lady sat five days for the finishing of one of her hands that leaned on an arm chair. For this reason not many would sit to him for their portraits; and he therefore indulged himself mostly in works of fancy, in which he could introduce objects of still life, and employ as much time on them as suited his own inclination. Houbraken states, that his great patron Mr Spiering allowed him a thousand guilders a year, and paid besides whatever he demanded for his pictures, having purchased some of them for their weight in silver; but Sandrart, with more probability, assures us, that the thousand guilders a year were paid to Gerhard, on no other consideration than that the artist should give his benefactor the option of every picture he painted, for which he was immediately to receive the utmost he demanded. This great master died in 1674, aged sixty-one.

DOVE. See ORNITHOLOGY.

DOVE ISLAND, a small island in Torres Strait, on the north coast of New Holland, about a mile and a half in circuit. The fragrance of the trees and shrubs with which it is covered perfumes the air.

DOVE-Tailing, in carpentry, is the manner of fastening boards together by letting one piece into another in the form of the tail of a dove. The dove-tail is the strongest of the assemblages or joinings, because the tenon, or piece of wood which is put into the other, goes widening to the extreme, so that it cannot be drawn out again, by reason that the extreme or tip is bigger than the hole.

DOVER, a sea-port in the hundred of Bensborough, in the county of Kent, seventy-two miles from London. It is built at an opening between two cliffs, and the streets run in a circular form under the western hill. The old streets are narrow, but of late years many new parts have been added on the eastern shore, which are handsome and airy. It is defended by forts and an ancient castle. The harbour has been formed by means of great labour and expense, and is dry at low water, but, when entered, safe. As the principal place by which communication with the Continent is kept up, it contains numerous inns and hotels, and the trade of the town arises in a great measure from casual visitors and travellers. Dover had formerly five churches, which are now reduced to three. It is governed by a corporation, with a mayor at the head of it. Two members are returned to parliament, formerly elected by the freemen, but now householders have also votes. There are markets on Wednesday and Saturday. The inhabitants amounted in 1801 to 14,845, including the liberty, in 1811 to 9074, in 1821 to 10,327 in the borough alone, and in 1831 to 11,924.

DOVER STRAITS, the narrow channel between Dover and Calais, which separates our island from the opposite Continent. These celebrated straits are only twenty-one miles wide in the narrowest part. From the pier at Dover to that at Calais is twenty-four.

DOVER, a post-town of New Hampshire, and capital of the county of Strafford. It is situated on the western side of the Piscataqua, and the Cochecho flows through it. This river has several large falls, which afford a considerable water power, which has much facilitated the progress of manufactures here. Dover has thus been rendered one

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of the most flourishing towns in the state. It contains a court-house, a jail, a bank, an academy, three places of public worship, and other public buildings. The greater part of the timber exported from the state is brought to this town. Dover owns considerable shipping; it is the oldest town in the state, having been settled in the year 1623 by two Englishmen. The population amounted in 1826 to 4160. It lies sixty miles north of Boston. Long. 70. 54. W. Lat. 43. 13. N.

DOVER, a post-town of Delaware, in the county of Kent, and seat of the government of the state. It is situated on Jones' Creek, seven miles above its entrance into Delaware Bay. The town is well built, chiefly of brick, and carries on a considerable trade with Philadelphia in flour. Long. 75. 30. W. Lat. 39. 10. N.

DOWAGER, *Dotisca* (a widow endowed, or that has a jointure), a title, or addition, applied to the widows of princes, dukes, earls, and persons of high rank only.

Queen dowager is the widow of the king, and as such she enjoys most of the privileges belonging to her as queen consort.

DOWER (*Dotarium* or *Dos*), a portion of lands or tenements which a widow enjoys for life from her husband in case she survive him, and which at her death descends to their children.

DOWLETABAD, a celebrated city and fortress of Hindustan, in the province of Aurungabad, deemed impregnable by the natives. The fort stands on the summit of a mountain, which is surrounded with several stone walls, the lowest of which incloses the town. The two lower fortifications are in this manner completely commanded by the upper. Like all the other hill forts of India, it is unhealthy, but is still considered as the key of the Deccan. This place, though it be remarkably strong, has been frequently taken. When the Mahomedan powers carried their arms into this part of the Deccan, about the year 1203, it was the residence of a powerful rajah, and was plundered of immense riches. In 1306 it was reduced by Mallek Naib, the emperor of Delhi's general. In the early part of the fourteenth century, the Afghan emperor Mahommed III. attempted to render this place, as its present name implies, the "abode of prosperity," and with this view he endeavoured to force the inhabitants of Delhi to quit their habitations and to emigrate to the Deccan; but he was unable to carry this violent scheme into effect. About the year 1595 Dowletabad surrendered to Ahmed Nizam, shah of Ahmed Muggur; and on the fall of his dynasty it was taken possession of by Mallek Amber, an Abyssinian slave. His successors reigned till 1634, when it was taken by the Moguls, and is now comprehended in the territories of the Nizam, but has much declined since the foundation of Aurungabad in its vicinity. Long. 76. 2. E. Lat. 19. 52. N. The district of Dowletabad is situated chiefly between the 19th and 20th degrees of north latitude, and extends along the north side of the Godavery.

DOWN, a county in the eastern part of the province of Ulster, in Ireland, is bounded on the north by the county of Antrim and Carrickfergus Bay, on the east by the Northern Channel and the Irish Sea, on the south by the same sea, and on the west by the county of Armagh. It measures, in its greatest length, from Cranfield Point in the south to Gray Point in the north, fifty-one miles, and in breadth, from the junction of the Newry Canal with the Bann near Portadown, to Ballyhalbert Point in the Ardes, forty miles, comprehending an area of 611,404 acres, or 955 square miles, of which 502,677 acres are cultivable, 108,569 are mountain and bog, and 158 are covered with water.

This county was anciently inhabited by the tribes of the Vinderii and Voluntii. After the arrival of the English,

who early formed a settlement here under the guidance of the celebrated John de Courcey, the principal families were a branch of the Oheils, distinguished by the name of Clanneboy, the M'Guinnesses, and the M'Artans, of Irish descent, and the Whites and Savages, descendants of the English settlers. Queen Elizabeth made it shire ground, but at what particular period of her reign has not been precisely ascertained. It is now divided into the eight baronies of Ardes, Castlereagh, Dufferin, Upper Iveagh, Lower Iveagh, Kinalearty, Lecale, and Mourne, and the lordship of Newry. These are again subdivided into fifty-seven parishes, and five parts of parishes, the remainders of which are in some of the adjoining counties.

According to the ecclesiastical arrangements of Ireland, the county comprises the diocese of Down, the greater part of that of Dromore, and the lordship of Newry. The former of these dioceses contains forty-nine parishes, consolidated into thirty-four benefices, having thirty-one churches. The cathedral was fixed at Downpatrick by James I., with a chapter consisting of a dean, four dignitaries, and three prebendaries; but in consequence of its subsequent decayed state, Charles II. erected the church of Lisburn into the cathedral of the united dioceses of Down and Connor. The part of Dromore diocese included in this county contains 21 parishes. Its cathedral is in the town of Dromore; also within the same limits, and near it, is the bishop's palace. The lordship of Newry is exempt from episcopal jurisdiction, a privilege which it enjoys from having appertained to a monastery before the reformation. The proprietor of the lordship exercises episcopal jurisdiction in his peculiar court, granting marriage licenses, probates of wills, &c. under the ancient monastic seal.

As far as inequality of surface is essential to scenic beauty, this county has strong claims to it, as it presents every variety of plain, hill, and mountain. The plains are chiefly confined to the vicinity of the rivers; the hills occupy by much the greater portion of the soil, insomuch that its appearance has been quaintly compared to a dish of spinach set over with eggs cut in two; and the mountains are piled together in one immense mass in the barony of Mourne in the south. The summit of Slieve Donard, the highest, is 2809 feet above the level of the sea. Slieve Croob and Slieve-na-boly, to the north of the principal group, and in a great degree detached from it, are also of considerable elevation.

The Mourne Mountains give rise to the four principal rivers, the Bann, the Lagan, the Ballynahinch, and the Newry water. The first-named of these rivers flows north-eastward by Banbridge and Portadown into Lough Neagh. The Lagan, after flowing northwards, takes an eastern direction, and passing by Lisburn and Belfast, separates the counties of Down and Antrim. The Ballynahinch discharges itself into the southern extremity of Strangford Lough. The Newry water is an insignificant stream, except where it is affected by the influence of the tide, and would be wholly undeserving of special notice, were it not that it has been made the commencement of a communication by water with Lough Neagh. The Newry navigation, the first canal completed in Ireland, commences at Fathom, two miles and a half below Newry, to which town it conveys vessels drawing nine or ten feet water. From Newry to the Bann is a canal for twelve miles, navigable for boats of from forty to sixty tons. Its summit-level is sixty-five feet above the sea, and twenty-two above the surface of Lough Neagh. The navigation thence to the lake is carried on in the river, a distance of nine miles, whence a communication by water to Belfast is maintained by the Lagan navigation. The chief trade on the Newry Canal is the import of bleaching materials,

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Down. flax seed, iron, timber, and foreign produce; the exports are grain, yarn, linen, cottons, and coal in small quantities.

Lakes, properly so called, are numerous, but insignificant in extent. Strangford Lough, otherwise called Lough Cone, is a spacious gulf, extending ten miles northwards into the land, and affording a secure roadstead to large vessels in its interior. Strangers, however, are unwilling to have recourse to it, through an apprehension that the rapid current of the tide, which rushes through the narrow strait between Portaferry and Strangford at the rate of eight or ten miles an hour, might drive them on some sunken rocks near its entrance. This gulf is studded with numerous islands, some beautifully wooded, others affording rich pasturage, but none inhabited. Bangor, Killybeg, and Ardglass, have each a harbour for fishing boats and small craft. An artificial harbour has been constructed at Donaghadee for the accommodation of the packet-boats to Scotland; but the introduction of steam navigation has rendered it comparatively useless. Near the coast of the Ardes, a long narrow peninsula between Strangford Lake and the sea, are the Green Island, Bird Island, and Burr Island; and at the entrance of Carrickfergus Bay is a group of three, called the Copeland Islands, upon one of which stands a lighthouse. There is another lighthouse on a sunken reef, called the South Rock, near the northern entrance of Strangford Lough.

The predominating soil is a loam of little depth, but good in quality. In most places it is intermixed with considerable quantities of stones of various sizes; a circumstance easily accounted for, as quarries are to be found everywhere not far from the surface. Clay is mostly confined to the eastern coast of the Ardes, and to the northern parts of Castlereagh. Of sandy soil the quantity is small, and chiefly on the sea coasts near Dundrum, where in some places its abundance and shifting nature have prevented any attempt at improvement. Moor grounds are mostly confined to the skirts of the mountains. Bogs, though frequent, are scarcely sufficient to form a supply of fuel to the numerous and increasing population. The husbanding and apportioning of them among the tenantry forms no small part of an agent's or land-steward's duties. There are several quarries of fine freestone. The best is that on Scrabo Hill, where a very close-grained and clear-coloured stone is raised. The quarries of Kilwarlin afford flags of large dimensions, varying in hue from a clear stone colour to a brownish red; the former are superior in beauty and hardness. Slates are raised in several parts; and though they cannot compete with the Welsh in lightness and colour, they are superior in hardness and durability. Limestone is not very general. Large blocks of a yellowish magnesian species are found near Hollywood, but this kind is not used for manure, except where the white is not easily attainable. Near Comber, on the shores of Strangford Lough, is a very hard and sparkling kind of reddish granular limestone. But the greatest magazine of this most valuable mineral is found in the vicinity of Moira. It is supposed to be a continuation of that mass which is perceptible, with little interruption, from Magilligan, in Londonderry, round the headlands of Antrim, to the range of mountains that lie north of Lisburn, whence turning westward, it is lost in the acclivities that border the Lagan between Moira and Magheralin. Here the quarries lie very near the surface. They consist of horizontal strata intermixed with flints, in some cases stratified, in others in detached pieces of various form and size. It is not unusual to see three of these large flints, like rollers, each a yard long and twelve inches in diameter, standing perpendicularly over one another, and held together by a narrow neck of limestone, funnel-shaped, as if they had been poured in a liquid state into a cavity formed to re-

ceive them. Various kinds of shells and other marine exuviae are found in this stone. Granite occurs in many places in detached masses, but the great body of it is confined to the southern and western regions, chiefly in the barony of Mourne. Yet though it is here the prevailing mineral, it does not wholly exclude the schist or slate, which is often seen in contact with it, raising itself from out of the middle of a surrounding mass of the former stone, which is itself in turn imbedded, or, as it were, set in the schist.

The mineral springs found here are of two qualities, sulphuro-chalybeate and purely chalybeate. The most celebrated of the former kind is at the foot of Slieve Croob Mountain, about two miles from Ballynahinch. In appearance, taste, and effects, it strongly resembles the waters of Aix-la-Chapelle. It is used both externally and internally, and has been found peculiarly effective in scorbutic affections. The town is much frequented in summer by invalids to enjoy its benefits. The chalybeate springs are numerous, and widely scattered through the county. The richest is that of Granshaw, in the Ardes. An alum spring has been discovered near Clough.

According to an account of the number of houses taken in 1751, the population, at an average of $5\frac{3}{4}$ ths to a house, amounted to 110,800, and, by a similar account, taken in 1791, to 220,519, thus doubling in forty years. Beaufort estimates it in the following year at 201,500. Dubourdieu, in 1802, states it to be 226,632. According to the parliamentary returns in 1812, 1821, and 1831, it increased progressively to 287,290, 325,410, and 352,571, having more than trebled itself in a period of eighty years.

The state of education, as collected from the parliamentary returns in 1821 and 1824-26, is as follows:—

	Boys.	Girls.	Sex not ascertained.	Total.
1821	13,081	64,65	.....	19,564
1824-26	13,456	83,75	997	22,828

Of the total number contained in the latter of these returns, 4347 were Protestants of the established church, 6120 were Roman Catholics, and 11,615 dissenters; the religious persuasion of the remaining 411 was not ascertained. The number of schools was 550; of which ninety-four, containing 6667 pupils, were educated by grants of public money; sixteen, containing 972 pupils, by the voluntary contributions of societies and individuals; the remaining 440, containing 15,595 pupils, were pay schools. The diocesan grammar school of Down is now formed into a joint district school for Down and Dromore.

The presbyterian form of worship predominates, especially in the towns and low country. In the mountainous part the Roman Catholic religion prevails to a very great extent.

During the existence of the Irish parliament this county returned fourteen members, two for the county at large, and two for each of the boroughs of Downpatrick, Bangor, Killyleagh, Hillsborough, Newry, and Newtownard. Since the union it is represented by four members, two for the county, one for Downpatrick, and one for Newry. The reform act has made no change in this respect. The state of the constituency, as affected by the changes made by the disfranchisement of the forty-shilling freeholders in 1829, and the subsequent alterations which terminated in the reform act, is as follows:—

	L.50.	L.20.	L.10.	40s.	Total.
1st Jan. 1829,	713	176	...	10,775	11,664
1st Jan. 1830,	720	252	1,018	...	1,990
1st Jan. 1831,	267	189	1,058	...	1,514
1st May 1832,	887	338	1,902	...	3,127
1st Jan. 1833,	...	...	...	...	3,127

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The land is very unequally portioned out among the inhabitants. There are many landed proprietors, mostly resident, each of whom holds large tracts in his own hands. Under these is a numerous tenantry of every grade, from those who deem themselves entitled to rank on an equal footing in society with the proprietors of the soil, to the holders of a few acres, who depend on their manual labour for the support of their families. The connection of all ranks hence arising has had a great effect upon the state of society. The great bulk of the population is orderly and industrious; their dwellings are better constructed and furnished than those of a similar class in most other parts of Ireland. The small farmers form a respectable body, honest, yet quickwitted and clever in their dealings, as might be expected from the density of the population, the constant intercourse, and the frequent traffic carried on in fairs and market. They are anxious to secure and to enjoy such of the comforts of life as are attainable by a vigorous exertion of industry and intellect. The processes of agriculture, owing in a great degree to the example set by the resident gentry, are as skilfully carried on as in any part of the united kingdom. The fields are well laid out and fenced, the crops laid down in a judicious succession, the progress of their growth carefully attended to, and the harvest well saved and secured. The most improved implements of husbandry are generally known, and their value is duly appreciated. The crops commonly cultivated are wheat, rye, bear, barley, oats, peas, flax, and potatoes. Barley is extensively grown, particularly in the light soil of Lecale. Green crops are also in general use. Much attention is paid to the culture of grass, particularly on the borders of the larger rivers, where extensive tracts of fine meadow land are annually enriched, by the overflowing of the banks, with deposits of the finer particles of mould washed down from the higher grounds. Lime and marl are in general use as manure. Horned cattle are principally reared for dairies, and therefore the same attention to figure and flesh is not paid as in some other agricultural districts. The resident gentry are, however, laudably emulous in the improvement of their respective stocks. The breed of horses is also an object of much attention. In the reign of James II. a public body was incorporated under the name of the Royal Corporation of Horsebreeders of Down, under whose auspices races are held annually at Downpatrick and at the Maze near Hillsborough. Some of the best racers in Ireland have been bred in this county. The native breed of sheep is confined to the mountains. They are a small hardy race, mostly horned, but in some instances not so. Though born in the mountains, they are removed during the first winter after birth to the more genial atmosphere of the lower country, and brought back on the return of spring. Many of this breed are well made and finely woolled. It is also much prized for the delicacy of its mutton. The various other kinds of sheep have been much improved by judicious crosses from the best British breeds. Hogs are reared in great numbers, chiefly for the Belfast market, where the large exportation occasions a constant and brisk demand for them. Hams of very superior quality are prepared from them in that town. Rabbits form a part of farm stock in the sandy southern tracts. Bees are found to thrive well, and hives have been constructed for the purpose of saving the honey without destroying the swarm.

Manufactures are carried on largely in the neighbourhood of Belfast and Newry. Several of the smaller towns also support some branches on a smaller scale. The linen manufacture still continues to be much attended to, but by no means so extensively as formerly; it is more and more superseded by the cotton every year. The finer

fabrics of linen were the object of particular attention. The woollen manufacture is confined to a coarse cloth wrought solely for home consumption. Kelp is made in large quantities along the shores.

The fisheries are by no means so extensive or flourishing as the great scope of sea-coast might lead to suppose. Belfast market is chiefly supplied from Carrickfergus, yet fish of every description abounds. Shoals of herrings frequently go up Strangford Lough, but they are not so much esteemed as those caught in the open sea. Smelts are taken in large quantities at the entrance of the same lough. The fishing for sand-eels at Newcastle is deemed to be of importance sufficient to require a code of regulations, adopted and enforced by the people themselves, to prevent the injuries and losses resulting from indiscriminate fishing. Shell-fish abound along the rocky shores, particularly in the neighbourhood of the Copeland Islands. Oysters are dredged at Ringhaddy, Carlingford, and Bangor. Mussels in inexhaustible numbers cover the shallow banks that stretch out before Holywood. They are chiefly consumed by the families in the immediate neighbourhood.

Several remains of antiquity, supposed to be coeval with the rudest ages of society, are to be found in this county. At Sliddyford, near Dundrum, is a group of pillar stones, consisting of ten or twelve, forming a circle. They are from eight to ten feet in height. A remarkable cairn stands on the summit of Slieve Croob. It is nearly eighty yards in circumference at the bottom and fifty at the top, forming a platform, on which several cairns of various heights and dimensions are erected. Another cairn near the village of Anadorn was found to cover a cave containing ashes and a number of human bones. Several cromlechs or stone altars have been discovered at various times. The most remarkable is in the Giant's Ring, on the summit of a hill between Lisburn and Belfast. The altar is formed of an unwrought stone seven feet long by six and a half broad, resting in an inclined position on several rude pillars from two to three feet high. It stands nearly in the centre of an enclosure about one third of a mile in circumference, formed of a rampart of earth about twenty feet high, sloping in on each side, and broad enough at the top for two persons to ride abreast upon it. Near Downpatrick is a rath or mount of earth three quarters of a mile in circumference. Its exterior consists of three artificial ramparts, the largest of which is thirty feet broad. The number of monastic ruins is also considerable. The most ancient and celebrated is the Abbey of Downpatrick, where the three favourite saints of the Irish, St Patrick, St Columba, and St Bridget, are said to have been buried. Near the abbey was a round tower, which was thrown down some years ago, when the abbey, now converted into the cathedral church, was rebuilding. Beneath the foundation of the tower a wall was found to proceed, crossing it, and extending to the main building of the abbey. Struel Wells, to the east of Downpatrick, merit notice from their connection with former religious observances. They are four in number, each covered by a stone vault, and having the water conveyed from the others by subterraneous aqueducts. Great numbers assemble here at midsummer's eve, and on the Friday before Lammas, to perform religious ceremonies, chiefly consisting of penances, and to obtain recovery from their bodily complaints. The ruins of many castles, particularly upon the coast, are still visible. Amongst the most remarkable is Greencastle, built on an islet in the barony of Mourne, and intended to maintain a communication between the English settlers in this county and those in the county of Louth. This castle was considered of such importance that no person but one of English birth was permitted to be constable of

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it. Dundrum Castle, erected on a rock near a small harbour in a bay of the same name, still preserves considerable vestiges of its former grandeur. At Ardglass are the remains of considerable fortifications.

Downpatrick, the county town, is situated at the extremity of the southern branch of Strangford Lough. It is said to owe its name to St Patrick, the founder of the abbey here, in which he was interred. The town, which consists of four streets meeting in the bottom of a valley formed by hills of some elevation, comprehends a surface of 1486 acres, and contains a population of 4780, according to the latest return. Vessels coming to the town are obliged to discharge their cargoes at the Quoill Quay, about a mile distant. The public buildings are, the cathedral, the court-house and assembly rooms, the jail, the barracks, the parish church, the Catholic chapel, some dissenting meeting-houses, the county infirmary, and the fever hospital. Near the court-house is an asylum for clergymen's widows, and an hospital for the decayed tenants of the Southwell estate. Two miles from the town is the race course, under the superintendence of the corporation of horsebreeders. The town is an ancient manor, governed by a seneschal. Previously to the reform act it was the most open borough in Ireland, as all persons who payed scot and lot, or boiled a pot in the town, were electors. Newry, situated in the south-western extremity, and extending into the adjoining county of Armagh, is of much greater size and of more commercial importance than Downpatrick. It covers 2500 acres, contains 13,370 inhabitants, and ranks as the twelfth of the principal towns of Ireland as to population. Situated at the extremity of Carlingford Bay, and connected by its canal with Lough Neagh and the Tyrone collieries, it enjoys peculiar advantages. Even in the earlier periods of British domination it maintained a high position, from being at the extremity of the pale, and serving as the key to the then unsubdued and generally hostile province of Ulster. In 1641 the town was taken and cruelly treated. In 1689 it was again stormed and reduced to ashes by the Duke of Berwick, to secure his retreat from Duke Schomberg. The public buildings are, a court-house, jail, exchange, assembly rooms, custom-house, theatre, and several places of worship. The environs of this town are of great beauty. The prospect towards the Bay of Carlingford is magnificent, and the villages of Narrow-water and Rosstown on its northern coast are objects of much interest to numerous visitors. The lordship, of which mention has been already made, is the property of the Needham family.

Harris's *History of the County of Down*; Dubourdieu's *Statistical Survey of Down*; Shaw Mason's *Parochial Survey*; Rutty's *Mineral Waters*; Nimmo's *Sailing Directions*; *Parliamentary Reports on Population, Education, and State of the Poor*.

DOWN, the fine feathers on the breasts of several birds, particularly of the duck kind. Those of the eider duck are the most valuable. These birds pluck the down from their breasts and line their nests with it. Three pounds of this down may be compressed into a size scarce larger than one's fist; yet it is afterwards so dilatable as to fill a quilt five feet square. That found in the nests is most valued, and termed *live down*; it is infinitely more elastic than that plucked from the dead bird.

DOWNHAM, a town in the hundred of Clackclose, in the county of Norfolk, eighty-four miles from London, and situated on the borders of Cambridgeshire. The river Ouse, which receives the Cam, runs near it. It has markets on Mondays and Saturdays. The inhabitants amounted in 1801 to 1512, in 1811 to 1771, in 1821 to 2044, and in 1831 to 2198.

DOWNTON, a town in the hundred of the same name,

in the county of Wilts, ninety miles from London. There was a castle here in former times. It has some trade in making paper, and in linen goods. It is an ancient burgh tenure borough belonging to the Earl of Radnor, and one of those recently disfranchised. The inhabitants amounted in 1801 to 2426, in 1811 to 2624, in 1821 to 3114, and in 1831 to 3652.

DOWNIE, a town of Central Africa, on the Niger. It has a manufactory of pottery ware, which is neatly made, and sold to advantage in the neighbouring countries. It lies twenty miles west-south-west of Timbuctoo.

DOWNS, a bank or elevation of sand, which the sea gathers and forms along its shores, and which serves it as a barrier. The word is formed from the French *dune*, or the Celtic *dun*, a mountain. Charles de Visch (*Compend. Chronolog. Exord. et Progress. Abbat. Clariss. B. Mariæ, de Dunis*) says, *Vallem reperit arenarum collibus, quos incolæ Duynen vocant, undique cinctam*.

DOWNS is particularly applied to a famous roadstead for ships along the eastern coast of the county of Kent, from Dover to the North Foreland, where both the outward and homeward bound ships frequently make some stay, and squadrons of men of war rendezvous in time of war. It affords excellent anchorage, and is defended by the castles of Deal, Dover, and Sandwich.

DOWRY, the money or fortune which the wife brings her husband in marriage; it is otherwise called *maritagium*, or marriage goods, and differs from dower. See DOWER.

DOXOLOGY, a hymn used in praise of the Almighty, and distinguished by the title of *greater* and *lesser*. The lesser doxology was anciently only a single sentence, without response, running in these words, "Glory be to the Father, and to the Son, and to the Holy Ghost, world without end, Amen." Part of the latter clause, "As it was in the beginning, is now, and ever shall be," was inserted some time after the first composition. Some read this ancient hymn, "Glory be to the Father, and to the Son, with the Holy Ghost;" and others, "Glory be to the Father in or by the Son, and by the Holy Ghost." This difference of expression occasioned no dispute in the church till the reign of the Arian heresy; but when the followers of Arius began to make use of the latter as a distinguishing character of their party, it was entirely laid aside by the Catholics, and the use of it was enough to bring any one under suspicion of heterodoxy. The doxology was used at the close of every solemn office. The western church repeated it at the end of every psalm, and the eastern church at the end of the last psalm. Many of their prayers were also concluded with it, particularly the solemn thanksgiving or consecration prayer at the eucharist. It was also the ordinary conclusion of their sermons. The greater doxology, or angelic hymn, was likewise of much consequence in the ancient church. It began with these words, which the angels sung at our Saviour's birth, "Glory be to God on high," &c. It was chiefly used in the communion service, and in private devotions. Both the doxologies have a place in the church of England, the former being repeated after every psalm, and the latter used in the communion service.

DRABLER, in nautical language, a small sail in a ship, which is the same to a bonnet as a bonnet is to a course, and is only used when the course and bonnet are both too shoal to clothe the mast.

DRABS, in the salt works, a kind of wooden boxes for holding the salt when taken out of the boiling pan. The bottoms of these are made shelving or inclining forwards, in order that the briny moisture of the salt may drain off.

DRACHM, a Grecian coin, of the value of sevenpence three farthings. Drachm is also a weight used by our

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Drachm.

Draco
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Dragon.

physicians, containing sixty grains, or three scruples, or the eighth part of an ounce.

DRACO, a celebrated lawgiver of Athens. When he exercised the office of archon, he framed a code of laws for the use of his fellow-citizens, which, on account of their severity, were said to be written in letters of blood. By them idleness was punished with as much severity as murder, and death was denounced against the one as well as the other. The rigour of this code of laws induced a certain Athenian to ask of the legislator why he had been so severe in his punishments; upon which Draco answered, that as the smallest transgression had appeared to him deserving of death, he could not find any punishment more rigorous for atrocious crimes. These laws were at first enforced, but they were often neglected on account of their excessive severity; and Solon totally abolished them, excepting that one which punished a murderer with death. The popularity of Draco was uncommon; but the gratitude of his admirers proved fatal to him. When he appeared at the theatre, he was received with repeated applause; and the people, according to the custom of the Athenians, showed their respect to their lawgiver by throwing garments upon him. But this was done in such profusion, that Draco was soon hid under them, and smothered to death by the kindness of his fellow-citizens. He lived about 624 years before the Christian era. See the article **ATTICA**.

DRACO, in *Astronomy*, a constellation of the northern hemisphere.

DRACONARIUS, in *Antiquity*, **DRAGON-BEARER**. Several nations, as the Persians, Parthians, and Scythians, bore dragons on their standards; and hence the standards themselves were called *dracones*, or dragons. The Romans are generally supposed to have borrowed the same custom from the Parthians; but Casaubon thinks they took it from the Daci; while Codin is of opinion that they owe it to the Assyrians.

The Roman *dracones* were figures of dragons painted in red upon the flags, as appears from Ammianus Marcellinus; but amongst the Persians and Parthians they were, like the Roman eagle, figures in full relief; so that the Romans were frequently deceived, and took them for real dragons.

The soldier who bore the dragon or standard was called by the Romans *draconarius*, and by the Greeks *δρακοναριος* and *δρακονορτοφος*; for the emperors carried the custom with them to Constantinople.

DRACONTIC MONTH, the time of the revolution of the moon from her ascending node, called *caput draconis*, to her return thither.

DRAGOMAN, or **DROGUEMAN**, a term of general use throughout the East for an interpreter, whose office it is to facilitate intercourse between the orientals and occidentals. Dragomans are kept by the ambassadors of Christian nations residing at the Porte.

The word is formed from the Arabic *targeman* or *targiman*, of the verb *taragem*, he has interpreted. From *dragoman* the Italians formed *dragomano*, and, with a nearer relation to its Arabic etymology, *turcimano*; whence comes *trucheman*, as well as *dragoman* and *drogueman*.

DRAGON, in *Astronomy*. See **DRACO**.

DRAGON'S Head and Tail (*caput et cauda draconis*), are the nodes of the planets, or the two points in which the ecliptic is intersected by the orbits of the planets, and particularly that of the moon, making with it angles of five degrees and eighteen minutes. One of these points looks

northward, the moon beginning then to have north latitude; and the other southward, where she commences south. Thus her deviation from the ecliptic seems, according to the fancy of some, to make a figure like that of a dragon, whose belly is where she has the greatest latitude, the intersection representing the head and tail, from which resemblance the denomination arises. But these points abide not always in one place, but have a motion of their own in the zodiac, and retrograde 3 minutes 11 seconds per day, completing their circle in 18 years 225 days; so that the moon can be but twice in the ecliptic during her monthly period, and at all other times she will have a latitude or declination from the ecliptic. It is about these points of intersection that all eclipses happen. They are usually denoted by these characters, ☊ dragon's head, ☋ dragon's tail.

DRAGONNEE, in *Heraldry*. A lion dragonée is where the upper half resembles a lion, whilst the other half goes off like the hinder part of a dragon. The same may be said of any beast as well as a lion.

DRAGOON, in military affairs. See **ARMY**.

DRAGOONING, one of the methods used for converting refractory heretics, and bringing them within the pale of the true church. The following is the method of dragooning the French Protestants, after the revocation of the edict of Nantz, under Louis XIV. as described in a French work translated in 1686. "The troopers, soldiers, and dragoons, went into the Protestants' houses, where they marred and defaced their household stuff, broke their looking glasses, and other utensils and ornaments, let their wine run about their cellars, and threw about their corn and spoiled it. And as to those things which they could not destroy in this manner, such as furniture of beds, linen, wearing apparel, plate, and the like, they carried them to the market-place, and sold them to the Jesuits and other Roman Catholics. By these means the Protestants in Montaubon alone were, in four or five days, stripped of above a million of money. But this was not the worst. They turned the dining-rooms of gentlemen into stables for their horses; and treated the owners of the houses where they quartered with the highest indignity and cruelty, lashing them about from one to another, day and night, without intermission, not suffering them either to eat or drink; and when they began to sink under the fatigue and pains they had undergone, they laid them on a bed, and when they thought them somewhat recovered, made them rise, and repeated the same tortures. When they saw the blood and sweat run down their faces and other parts of their bodies, they sluiced them with water, and, putting over their heads kettle-drums turned upside down, they made a continual din upon them till these unhappy creatures lost their senses. When one party of these tormentors were weary, they were relieved by another, who practised the same cruelties with fresh vigour." Such is persecution in its naked form.

DRAGUIGNAN, an arrondissement of the department of the Var, in France, extending over 1078 square miles. It is divided into ten cantons and fifty-eight commons, and contains 75,387 inhabitants. The chief place is a city of the same name, situated on a fine plain, rich in vines and olives. It is a well-built town, and stands on the river Pis, where there is a public library, a museum of natural history, and many oil and silk mills. It contains 8010 inhabitants. Long. 6. 29. E. Lat. 43. 44. N.

DRAIN, a cut or ditch for carrying off water from the soil, to improve it for the purpose of agriculture.

Dragonnee
||
Drain.

DRAINING.

Draining. To drain land means simply to make land dry. This definition is satisfactory in regard to the ancient art of draining, the object of which was to render land which was wetted by springs, or had become marshy by stagnant water, or subjected to the periodical overflowings of rivers, sufficiently dry to permit the exercise of arable culture. It is not so applicable to the modern practice of draining. Draining is now practised on land that is apparently dry, as well as on really wet land. Land that contains a superabundance of water produces plants of a peculiar nature, such as rushes, flags, sprots, and many others; and obstructs the operations of arable culture. The very existence of such plants is sufficiently indicative of the wet state of land. But land that contains no such superabundance of water as to obstruct its arable culture, but which, by its inherent wetness, may nevertheless prevent the luxuriant growth of the cereal grains and the cultivated grasses, requires draining as much as wet land, though wetness is not so *apparent* in it as in the other. The deficiency of the crop on apparently dry lands is naturally attributed to unskilful husbandry, till experience proves that no management, however skilful, can counteract the baneful influence of concealed stagnant water. Observation teaches us that stagnant water, whether on the surface or immediately under the surface of land, injures all the useful classes of plants. How the injury arises is not very clear; perhaps by obstructing perspiration and intro-susception, and thus diseasing their roots; or, what is more probable, it prevents their food from being presented in a nutritious state, by checking the chemical decomposition of the substances which supply the food of plants. Whether the true cause of the bad effects of stagnant water on the vegetation of useful plants will ever be discovered, the future progress of vegeto-physiological science can alone determine. In the mean time, experience assures us that draining will remove these bad effects.

It thus appears there are two species of draining; the one draws off the larger bodies of water which are collected from the discharge of springs in isolated spots, and the other absorbs the superabundance of water from and under the surface of the land. The first is called *under-draining*, because it intercepts the passage of the water from springs at some distance under ground. The second makes channels for conveying away the water which falls on the surface of the ground, and is therefore called *surface-draining*. Surface-draining is again divided into two kinds; the one consists only in making small open channels and furrows immediately on the surface of the ground; the other is effected by means of small drains constructed at a short distance under the surface of the ground, in order to collect the water which would otherwise remain on a retentive subsoil at the bottom of the plough furrow. This latter kind derives its name from the particular construction of the drain.

The theory on which these different kinds of draining are founded is sufficiently explicit. Where the upper surface of land is at all permeable to water, and where it rests on beds of matter of different depths, of various lengths and breadths, each possessing a consistency of retentiveness or permeability, the water produced from rain, snow, or dew, in its progress along the porous bed, will be interrupted and retained by the retentive beds, and will accumulate in them in larger or smaller quantities, according as they present a basin shape, over the edge of

which it will burst through the upper surface in the form of springs. Hence the necessity of *under-draining* to draw off the water contained in the basin-shaped curves of the retentive layers. Where the upper surface is permeable, and the subsoil immediately under it retentive, water will accumulate on the subsoil, to the injury of plants growing on the surface soil. Hence the origin of *surface-draining*, by laying land in ridges, and forming small open channels, along which the water percolating through the surface soil may have a free passage. Where the subsoil is so porous as to permit the water to percolate through it beyond the reach of the plough, these open surface gutters will have no effect in removing the superabundant water. Hence the second class of surface drains must then be constructed to absorb it. Where the surface soil and the subsoil are both permeable, they will hold water only by capillary attraction; and what is not so retained will sink down into the inferior permeable beds by its gravity. Hence in such land draining is unnecessary. Of these excessive supplies of water, that from springs is most injurious to the vegetation of useful plants, as being colder, and generally more permanent in their operation. Capillary attraction will retain as much water in the surface soil as vegetation requires, excepting under the extraordinary occurrence of excessive drought. Hence the abstraction of water by draining is quite independent of its supply as a manure, as a meliorator of the soil, as a menstruum for food, or as a regulator of temperature to plants.

These statements prove the necessity of a knowledge of geology for a perfect understanding of the principles of draining; and fortunately practice in this department of rural economy is not at variance with scientific principle. On the contrary, he who is best acquainted with geology and the principles of hydraulics, will constitute the most scientific drainer. But such a character cannot yet be easily acquired by any man; for that department of geology, the knowledge of which is most applicable to the art of draining, is the most difficult to be understood, and has hitherto been the least explored. Most of the arable soil is contained within the tertiary and alluvial formations of rocks. The intricate relations of the newer beds, which compose the alluvial class of rocks, and which are the most intimately connected with arable culture and draining, present almost insurmountable obstacles to the thorough acquirement of the art of draining. They at least throw an uncertainty over its operations; and this uncertainty must continue till the relations of the alluvial rocks are discovered to be as fixed as those of the other classes. Perhaps this certainty is unattainable; because it may be that the newer members of the alluvia strata do not bear a strictly relative position to one another. But till this fact is ascertained one way or the other, draining must be conducted in a great measure in these alluvial deposits by trial. In undertakings on trial, error generally ensues, and unnecessary expense is often incurred. One very unfortunate circumstance, arising from the uncertainty attending draining, is the uselessness of the experience acquired in one set of operations, in guiding to a means of securing a more certain result in another. As uncertainty attends on the number and depth, and even direction, of the drains which are required to dry one field sufficiently, so a similar uncertainty prevails over the similar operations in the adjoining field. Every drainer will concur in the justness of these remarks. A deeper study by geologists in this

Draining. branch of geology would therefore confer everlasting obligations on the drainer; and would they also direct their particular attention to the connection between the upper surface of the earth's crust, and the one immediately subjacent, that connection would perhaps be found to be intimate; or, at all events, the investigation would supply desirable materials for a correct nomenclature and classification of soils.

It does not appear that the ancients practised draining. The Egyptians, Indians, and Persians, and indeed the inhabitants of the tropical regions, rather practise the opposite though almost sister art in effect, namely, irrigation, on land which is beyond the influence of the great periodical overflowings of rivers. The Greeks had neglected draining; and indeed they did not attend much to agriculture. The Romans, on the other hand, skilful husbandmen in every department of agriculture, drained their lands with the greatest care and assiduity. Cato, their oldest writer on agriculture, enters so minutely into the importance of draining, as even to prescribe the dimensions and shapes of open and covered drains. The Romans had only been acquainted with the draining of springs, and the clearing away of surface water. For the former purpose the drains were left open at both ends, and the water from the springs was conveyed away by them out of the field, as particularly described by Columella. For taking away surface water they used open ditches in stiff soils, as Palladius informs us; and Cato directs that when the rain commences in autumn, all the servants should go out with sarclles, or other iron tools, open drains, turn the water into the channels, and take care of the corn fields, that it flow from them. It thus appears that the Romans were unacquainted with the deeper kind of surface-draining. In our own country draining has been practised for a long period. Ingulphus mentions that a chamberlain of William the Conqueror, Richard de Rulos, lord of Brunne and Deeping, drained a great extent of country, and embanked the river Wielland, which used to overflow the neighbouring county every year. It is more than probable that draining was practised in this country long before that period, as the Romans invariably introduced the arts of life into every country which they conquered. Fitzherbert's *Boke of Husbandrie*, which was published in 1534, during Henry VIII.'s reign, contains minute directions for draining. But the greatest impulse which draining received in Britain was in the latter half of the last century; and that was given by a practical discovery of the seat of springs, by a farmer, Mr Elkington of Princethorpe, in Warwickshire. Being an uneducated man, Elkington was not able to communicate his ideas to the public. Mr Johnstone, a drainer residing in Edinburgh, under the authority of the Board of Agriculture, published a full and satisfactory account of Elkington's mode of draining wet land. Elkington was ignorant of geology, and could not therefore have acted on scientific principles. These principles Farey, in his report of the agriculture of Derbyshire, maintains that many contemporaries of Elkington understood better than he did. But whatever might have been Elkington's personal qualifications, it cannot be denied that the mode of draining which he practised himself, and which he showed to many farmers and country gentlemen, produced a complete revolution in that art in this country. His principle was simple and strictly scientific, though he was probably not aware of its scientific character, or of the science which it involved; but it was undoubtedly its scientific nature which caused it to be attended with such success. He applied his principle chiefly to the draining of springs, which was simply to intercept the water by a drain at its source or spring; and the wetness in the land arising from that source will of course be removed. The cutting the

drains deep is almost essential to the success of his system. Draining. The difficulty in the application of the principle consists in discovering the seat of the spring. A minute knowledge of the alluvial rocks would overcome this difficulty. In the present state of that knowledge, shrewdness must perform the part of science, assisted by trials in digging pits or cutting straight ditches through the beds of earth, in order to ascertain which of them contains the spring.

The drains which our forefathers made rested on the subsoil, immediately under the surface soil; and their depth under the surface depended on the depth of the upper soil. But as the depth of the arable soil, when it is of a different nature from the subsoil, is never very great, these drains were necessarily shallow. As experience, however, would soon teach men the impropriety of placing the stones in a drain within reach of the plough, few stones were placed in them, often not exceeding three, one on each side of the cut, and another above them, forming a sort of conduit. These conduits being near the surface, and of small areas, an additional quantity of water, or moles digging across them, placed such obstructions in them as to prevent entirely the flow of the water. They then became receptacles of water, and produced the mischief they were intended to remedy. Many of these drains are met with in the soil; and they appear to have been formed on the notion that a conduit to convey the stagnant water between the upper and subsoils was quite sufficient to render the soil permanently dry. The discovery of these trifling drains compels us to the belief of the fact, that the mode of draining practised by the Romans, and which without doubt they had introduced into this country, had been neglected or forgotten in the dark ages, previously to the revival of agriculture in Britain in the reign of Henry the Eighth.

Compared with the paltry method just described, the system of Elkington is super-excellent. No wonder that it produced at the time of its introduction a revolution in the art. It was as much more effective than the old system in changing the quality of the land, as blood-letting with a lancet from a vein affects the general constitution in a greater degree than the topical application of leeches. Elkington's discovery also created discussion, which terminated in the permanent establishment of the present method of draining practised in this country. This method is a modification of that of Elkington; and it is an improvement, in as far as it effectually drains a species of wetness in land, for which his method is perhaps not so suitable. It is fully granted, that to drain bursts of water and marshy ground, it is necessary to cut off the springs which supply them with water; and that whatever depth of drain or strength of materials are required to effect these purposes, they ought to be executed. In this manner many extensive properties have been drained, at great expense it is true, but so effectually, that the increased income derived from the improved quality of the soil, and the more rapid growth of the trees, will continue as a permanent fund, from which the expense of the improvements will be amply repaid. Granting these advantages, with which, however, it is not intended to intermeddle, it is nevertheless maintained by many that the portion of land which is wetted by water springing from below, bears a very small proportion to that which is in a wet state from the retention of rain water on an impervious subsoil. A great extent of land may be wetted by the bursting out of a spring of water; and the obvious mode of drying that land is to remove the spring; but will the same mode of draining, dry land which is wetted to a great extent by rain water being retained in the surface soil like water in a sponge, in consequence of a retentive subsoil? Obviously not. A drain in a retentive subsoil cannot draw wa-

Draining. ter from a distance. A number of drains should therefore be made, all to co-operate by their absorbing power, in order to remove the water from the retentive subsoil; and as drains cannot draw water from a distance in a retentive subsoil, so in such a subsoil they need not be made deeper than to contain a sufficient quantity of materials to ensure their durability. This method of draining may be as expensive or more expensive than the system of draining springs; but whatever may be its expense, the increased produce and the improved quality of the subsequent crops will soon repay it. The theory on which this method is founded is also purely scientific. In the natural circumstances of the upper and subsoils, varying from light dry loam resting on beds of sand and gravel, to a thin steril crust, incumbent on impervious clay, the drainage must be various. In the former no water springs from below; and what falls upon the surface is immediately absorbed and carried down beyond the reach of vegetation. In the latter case, water, whether springing from below or falling on the surface in the shape of rain, must, where there is a declivity, run slowly off over the surface, however great the distance; or, in the event of a level surface, must remain stagnant till evaporated by the sun. On such a subsoil, a sufficient depth of *active* soil cannot be long maintained; for even if enriched with lime and manure, it will bear scanty crops; and if laid out for pasture, it will in a few years revert to its natural state, and produce only coarse herbage. Some soils rest on subsoils partially permeable by water. Such, in dry seasons, with judicious management, produce good crops; but in rainy seasons the crops are thin and the grain inferior in quality. When soil is immediately incumbent on open rock, such as the trap rocks, which contain many fissures, the land is uniformly fertile. Thus carefully copying the operations of nature, if drains were made in retentive subsoils, so as to give water frequent opportunities of escape, the soil would then become fertile, like the soil which rests on the open rock. Hence the drains are made straight and parallel to one another, and as near to each other as is necessary for the effectual drying of the land. These parallel drains are placed down the inclination, instead of across the land.

Strong objections are urged against this system of surface-draining by those who are strenuous advocates of Elkington's mode of cutting deep drains across the face of inclined ground. They maintain that fewer of these cross drains will dry the land than those which run straight down the inclined ground, and that these small drains will only serve a temporary purpose, and will have to be renewed at no great distance of time, at a greater cost than the making of cross drains. Such objections to the parallel straight drains are not so strong as they appear. It might be supposed, indeed, at first sight, that a drain passing across a piece of inclined ground will more readily intercept the descent of water than drains passing down in a direction parallel to the course of the water. But the fact is, in all pieces of ground which lie at an inclination, there is a double inclination, the one *down* the face of the inclination, which is always the greatest, and the other *across* its face. Water running down a double inclination will of course take the direction of the diagonal, in the exact proportion the angles of inclination bear to one another, provided the substance of the subsoil were homogeneous. As it is very improbable that the subsoil should be homogeneous, there is a risk of cutting the cross drains parallel to the course of the water, in which case they would not intercept any of it; whereas numerous drains cut parallel to the direction of the ridges on the inclined ground, would certainly intercept the water in its diagonal and devious course. Should the adoption of small drains cause

them to be superficially constructed, this defect would be a strong objection against the whole system; but substantial drains are as necessary in this as in the other system. Drains which are to contain broken stones, and no other material will answer the purpose in a retentive but spongy subsoil, should *not be less* than thirty inches in depth; one foot for the passage of the plough over the stones, and eighteen inches of small stones. This is the *least* size the drains should be, and of this size they will endure for generations. In this mode of draining it is proposed to make the drains three feet deep.

Having explained the *rationale* of different modes of draining, it will be necessary to give a minute detail of the mode of forming the different kinds of drains.

It is scarcely necessary to state that all drains must be cut in a direction to permit the water in them to run down hill. No drain should be made more level than an inclination in the bottom of one foot in twenty-five yards. With this fall water will easily gravitate in a drain. Drains formed for the purpose of drying springs which are not in the immediate vicinity of marshy ground, should be four feet in depth at the least. A reservation is made in case of marshy ground, for it is probable that its vicinity will not afford a fall of four feet. All drains of four feet in depth should be filled with small stones gathered from the fields, or stones from the quarry broken small for the purpose; and such drains should always be built with a conduit of dry masonry, of a size in the opening proportionate to the quantity of water which it is supposed will run through them; and the size of this conduit will of course regulate the breadth of the bottom of the drain to be cut out. In all cases of conduits they should be built on a bottom floored on stones; for in many kinds of clay which have a mixture of sand (and in all drainable clays such a mixture does exist), the water, if considerable, will wear away the clay from under the conduit, and cause sinkings in the drain. The small stones should be carefully packed around the conduit with the hand till it be covered, and the remainder thrown in from the side of the drain by the hand, to within eighteen or fifteen inches of the surface of the ground. When the filling is completed, the stones should be neatly levelled; the filling should commence immediately after the cutting is finished, which should be executed in small portions at a time. The stones should be covered over with any material which will prevent the loose earth trickling down through them into the drain, such as straw, which is perhaps too valuable an article for this purpose, turf with the grass side downwards, or quicken well shaken of its earth gathered from the fallow fields. The levelling of the earth which has been cast out should be executed as soon after the filling of the stones as possible, and it should be carefully and not slovenly performed; as a ridge of earth, however small, placed across a piece of inclined ground, and which cannot afterwards be removed till the field is ploughed up again, will intercept the water in its descent down the furrows, and there cause that moisture in the ground which the draining was intended to remove. An easy method of levelling the earth is to put some of it in the first place with the spade over the covering of the stones, and then to pass the plough and turn the earth over into the drain in the same direction, returning the plough empty. This operation may be repeated twice or thrice, according to the quantity of earth to be levelled, and then a space of the adjoining ground may be ploughed with that thrown out, in the manner of a common ridge, till the whole is flat. It is almost always recommended to fill drains from their upper end towards the mouth. This may be a desirable arrangement when the drain is necessarily very level, in order to preserve the fall, but never

Draining. otherwise; for the risk which is incurred should wet weather set in, by the falling in of the sides, while waiting for perhaps a great length of cutting, would more than counteract any advantage of preserving a minute level. These general observations on the cutting and filling and covering of drains apply to every species of drain. Other general observations are, that main drains, into which the lateral drains empty themselves, should be larger than the lateral ones. Main drains should be cut in the nearest and most convenient hollows for the outlet of water from the fields. All lateral drains should enter the main drain, or other lateral drains, with an acute angle of confluence, to expedite the water in its course. The mouths of main drains should be left open, strongly built, and defended with wooden or iron bars, to prevent the ingress of the larger class of vermin, such as badgers, foxes, and polecats.

Where square stones cannot be easily procured for the building of conduits, and where flat stones are more plentiful, they should be used in *coupling*, that is, one should be laid flat on the bottom of the drain, and other two set up on it, meeting at the top, the three forming an isosceles triangle. Small stones should then be packed carefully with the hand along the side and over the apex of the triangle. This coupled drain is perhaps not so strong as a built conduit, but it may be made very durable if the stones are of compact structure, and it is less expensive, as it requires a narrower cut than the conduit.

Drains from three and a half to two and half feet deep should be wholly filled with small stones. They are termed *rubble drains*. They need not exceed the breadth of a garden spade at the bottom. The small stones with which they are filled should not exceed the size of the fist, and they should be thrown in by the hand from the side of the drain; not carelessly against the sides and on the bottom of the drain, but rolled down, as it were, the inclined face of the stones already filled in. In this manner they will arrive easily at the bottom, and find their own position. When rubble drains are formed in hazel loams, they become the favourite resort of earthworms in search of fresh and unexhausted soil. Moles soon follow them, and these may cause damage to the drains if precautionary measures be not adopted. The pressing of the smallest stones by the foot into the bottom of the drain, to form a sort of causeway upon which the other stones are placed, is an insuperable obstacle to moles running under it, and heaving the earth up into the drain.

It has always been recommended to build conduits in quicksands; but the circumstance most deserving notice in the drainage of these troublesome things is the laying the bottom of the drain with flat stones, and building up its sides with a sort of masonry, in which pieces of turf should act as mortar, to prevent the sand running into the middle of the drain. Instead of leaving the conduit open, it should be filled up with small stones carefully packed in with the hand, because this construction is the strongest for resisting the lateral pressure of the quicksand.

In regard to the comparative advantages of a conduit and rubble drain, where no necessity exists of making the drain so deep as the stones at the bottom would be pressed into the earth by the weight of those above them, and this injurious effect will not be produced at a less depth than three and a half feet, no better materials can be employed to fill drains than hard round stones not exceeding the size of a goose's egg. It will be quite unnecessary to be at the expense of conduits and couples in all those shallow drains formed in retentive subsoils not containing springs. Water in the quantity generally found in drains, percolates through rubble stones with less injury to the drains themselves than in conduits; because, after a tract of wet wea-

Draining. ther, when the water in all drains is more or less turbid, according to the soil through which it passes, the rubble drain retards its current throughout its whole course, and causes it to deposit what portion of earth may be mechanically suspended in it, in a gradual manner; whereas the rather rapid current in a conduit will deposit its earth in quantities in every eddy which it forms, and in the course of time banks of earth will be formed in the conduit at different places, so as to affect the depth of the drain above those deposits.

Tiles made on purpose for drains are now very frequently used instead of stones. They are sometimes made in the shape of long truncated cones which fit into one another, but more commonly in semicircular pieces placed upon flat tiles. Where stones can be procured for the gathering, or quarried near at hand, and a sufficient quantity can be obtained of them, they are in every case superior to tiles for draining. Tiles may be beneficially used in conjunction with stones when the latter are carefully packed around, and of a sufficient depth above the former. They may also be used in clay soils, if well packed in a mass of peat moss. Clay soils seldom contain stones, but are often associated with peat. Tiles at present (1833) are for the most part used in *furrow-draining*, that is, in drains cut in any furrow between the ridges. These drains are generally made twenty inches in depth, one foot wide at the top, and two or three inches at the bottom. Sometimes small broken stones to the height of ten inches are used in these drains instead of tiles. With whatever materials they are filled, such a size of drains is objectionable. If intended to drain springs, they are incompetent to reach their source; if surface water arising from rain lodging on an impervious subsoil, the paucity of materials in them deprives them of utility and durability. Such a system can only serve a temporary purpose; and in a permanent improvement such a motive should always be proscribed. Draining insufficiently performed is nearly as bad as leaving it undone. Its defects cannot frequently be discovered till a great loss has been sustained.

Another method of draining has lately been introduced, and is termed *plug-draining*. It is exclusively confined to the draining of tenacious clay, and chiefly practised on pasture land. It consists of removing the turf with a common spade twelve inches in width and six inches in depth. The clay under the turf is removed with a narrow-shaped instrument called a grafting iron, on the side of which is raised a cutting bit six inches long, to the depth of eighteen inches. The drain is made two feet deep, one foot in breadth at the top, and one inch and three quarters at the bottom. Plugs of wood to fit the bottom of the drain, one and three quarters of an inch wide at bottom, four inches at the top, and six inches in height, and of any length, perhaps a foot, are then placed in the bottom. The clay last taken out of the drain is returned into it and rammed hard down, until the whole clay thrown out is replaced in a solid mass into the drain. Upon the clay the grass turf is replaced in its original position. The plugs are then withdrawn from below the clay to within eight inches of their length, by means of a lever acting upon it with a chain attached to the end of the plugs. Three or four of these plugs are united together by iron slips, which permit them to have as much play as to accommodate themselves to any curvature or inequality in the cutting of the drain. Expedients for draining the surface of grass lands have frequently been attempted; such as turning over a turf slice with the plough, paring the earth off the bottom of the turf slice with a spade, and replacing it. The drain thus made is like a large mole gallery, and hence it is called *mole-draining*. But this and the plug-draining, and all other expedients of the like kind, are

Draining. but temporary shifts. They all originate in a false notion of economy. The advantages of draining can only be obtained when it is effectually executed, and it cannot be so executed without a considerable expense. Its operations being beyond the reach of daily observation, is a strong reason for executing it effectually. To be obliged to rectify the errors of draining is a serious evil, and will always cost more than a judicious primary outlay.

The minor adjuncts connected with Elkington's mode of draining springs should not be overlooked. They consist of *boring* with the *auger*, and *sinking pits*. Where tenacious beds of clay of moderate thickness forming retentive subsoils rest on gravel or sand, or open rock, holes bored through them with the auger when their depth is considerable, or pits sunk through them when they are less so, may effect a very considerable saving of expense. There is obviously no use of cutting a great length of a main drain, merely as a conveyance for water, when a hole or a pit opened on the spot would effect a similar purpose. In many cases, rich marshy land, and land-locked lakes, cannot be drained in any other way. A correct knowledge of geology is essentially necessary in this department of draining, in order to arrive at the desirable result with the least trouble.

These various modes of draining, which have been but imperfectly described, are executed in what may be termed different *styles*. Elkington's mode presents a ramified or dendritic appearance. The main drains occupy the lowest parts, or the hollows of fields. From them the lateral drains branch out in various lengths in a sloping direction along the inclined face of the ground. Where springs abound at the foot of mountain ridges, and where the substratum consists of beds of sand, however thin, interlayered with thick beds of impervious clay, and where the water evidently rises from *below*, this is the most beneficial system of draining which can be followed. The upper soil on such a substratum is generally a clay loam, unprofitable when wet, but extremely grateful when dried. With deep ploughing, plentiful liming, and liberal manuring, after drainage, such land will continue for ages to produce wheat, clover, beans, and Swedish turnips, in abundance. The expense of this method of draining is considerable by the rood, though not by the acre. It will be more than a shilling per rood of six yards; but not exceeding L.3 or L.4 per imperial acre. These clay loams almost always rest on inferior kinds of clay, of various qualities and colours. They rest on retentive subsoils, generally occupy large flats, large detached patches, knolls, and often run in bands across part of the country. In hollow portions of ground, mossy soils of little depth rest on these clays. In examining the structure of the subsoil on which these clay loams rest, it is probable they have been deposited when the retiring waters were nearly in a quiescent state. Though the different kinds of clay, often exhibiting different colours, are not arranged in horizontal or parallel beds, they appear in undulating beds of different lengths, and of contemporaneous formation, and these are frequently divided by thin beds of sand. These undulations act as basins to intercept and collect the water which permeates gradually through the detached beds of sand. This permeant properly permits them to contain large quantities of water, and hence this class of soil is very wet, and difficult to manage before they are drained. Very frequently a thicker bed of sand than the rest divides the mixed clayey subsoil from clay of a different and generally more homogeneous structure below it; and in cases where this homogeneous clay is not more than six feet below the surface, and it is often less, it forms an excellent flooring for a main drain.

Draining. Another style of draining has lately assumed the appellation of the *frequent-drain*. It consists of cutting parallel rows of drains down the face of inclined ground, which terminate in a main drain in the lowest part of the field. Contrary to the mode of draining just mentioned, this will cost little per rood, and much per acre. The expense in the hardest clay subsoil will not exceed tenpence per rood of six yards; but from the number of drains required, it will cost in such a subsoil nine or ten pounds per imperial acre. The cost of course will be in proportion to the obduracy of the material to be operated upon. In clayey subsoils generally of a reddish hue, containing small round and angular stones, frequently round masses of slaty sandstone, sometimes water-worn boulders of the older formations, and isolated veins of sand, this species of draining is admirably adapted, provided the drains are made of a sufficient depth to contain eighteen inches of small stones. This subsoil often continues of the same structure to a great depth, and it is very retentive of water, which has its origin in it chiefly from *above* in the shape of rain and snow. Deep draining is quite inapplicable to this subsoil. From the very structure of the subsoil, it is clear that digging the drains beyond a certain depth will confer no advantage. Water permeates such a subsoil only through the sand which it contains; and as that exists in an isolated state, it is not in the power of any drain to attract moisture from a distance. Dark hazel-coloured loams and black mould generally rest on these subsoils. These soils, when drained, form good turnip land, are sound for the rearing and feeding of live stock, raise barley of fine quality, and will carry good winter and spring wheat, when clay enters into their composition. In deep loams, where the *influence* of moisture is *remote*, draining, at least deep draining, is unnecessary. It is more necessary in thin loams, as the proximate relation of the subsoil to them in regard to a state of wetness has a direct influence on the productive powers of the soil.

Furrow-draining consists of cutting a drain in every furrow between the ridges, and these drains will be crooked or straight as the furrows are so: the drains terminate in a main drain at the lowest part of the field. The only instance where furrow-draining can be safely recommended is in pure clays, where the soil from time immemorial has been formed into broad, high, crooked ridges, the furrows of which cannot with propriety be changed in ploughing the land, as may be done with most other soils. Many of these furrows contain surface water during a great part of the year, which frequently destroys the crops half way up the sides of the ridges, the general declivity of the surface of the land being unable to convey away the water without the assistance of drains. But instead of making these furrow-drains two or three inches wide at the bottom, as is usually done, they should never be less than the breadth of a common spade, and filled eighteen inches high with small stones or gravel, or tiles with peat moss, and the remainder to the top with porous earth. Pure clays, which extend to some depth, and which have the upper and subsoils composed of homogeneous clay, if judiciously managed, require no draining at all, not because they are not wet soils (on the contrary they are very wet soils), but because water cannot permeate through them, except as far as the plough reaches. Such soils may be effectually dried by deep ploughing, and keeping the furrows always clear with the spade. To keep such a soil dry, a practice might be beneficially taken from Irish agriculture. It is called *double shovelling*. This is done after the land is water-furrowed. A cutting plough drawn by two horses, one before the other, is passed along the furrow. The plough goes and returns close to the sides of the ridges, and at six inches deep, thus furnishing fresh mould, and pre-

Draining. serving a narrow furrow, the shovelling with the shovel or spade being completed from its depth instead of its width; and if the mould be thus ploughed in dry weather, it can be shovelled even after receiving rain. In retentive soils these furrows are absolutely necessary; and by the foregoing method, the extra covering for the ridge, by which some harrowing is saved after the sowing of the seed, is produced with nearly as little waste of ground as by the common water-furrow drawn by the plough. All flat clay deposits, or what are called Carse in Scotland, are composed of this kind of soil, and many detached fields on the sides of winding rivers may be found of a similar character. They cover a very inconsiderable portion of the face of the country, though in productive powers they stand in the first rank of soils.

Sandy soils resting on sand require no draining. They are found occupying extensive flats on the estuaries of large rivers. All soils resting on a subsoil of gravel are naturally dry. Drought alone injures them. It is remarkable that all soils which rest on gravel are a light loam, of a light hazel-brown colour, whether they have a siliceous or alluminous basis. These constitute the true turnip soils, and are to be found on the banks and haughs of straight-running rivers, rapid streams, and fresh-water lakes.

A thorough knowledge of the various modes of draining is not alone sufficient to constitute a good drainer; he should know the principles as well as the practice of his art. The difficulty is not so great in constructing a drain, as in knowing *where* it should be made. A true knowledge of whether the wetness in land arises from springs or stagnant water under the surface of the soil, can alone teach a man *where* to open up the ground. Every manager of land unfortunately thinks he possesses that knowledge, and the consequence has frequently happened that small drains have been opened where only deep ones should have been, and much money expended in making deep drains where smaller ones would have answered the purpose. But the former error is greater than the latter. In neither case, however, has the money expended been thrown away. A certain degree of success has attended every attempt at draining; and this favourable result, perhaps, more than any other circumstance, has beguiled many into the belief that they are accomplished drainers; for no one, however incapable he might be of directing the operation aright, would even make the attempt to drain land until he had actually experienced an obvious injury arising from wet land. It must be confessed that many improvements effected by draining have been purchased at a greater cost than was necessary to accomplish the end. Many attempts have been made at draining land by men who did not know how to accomplish it to the best advantage either to themselves or the land. The outlay of their money has therefore been ill directed. Were the evil effects of ignorance confined to the squandering of a little money, they might be counteracted by superior management in the other operations of the farm. But, unfortunately, the sinking of valuable capital in injudicious draining, deprives the farmer of the means of pursuing other improvements, and prevents his reaping all the advantages derivable from draining itself. Thus crippled in his resources, he cannot put and maintain his farm in the highest condition; for such is the generous character of our farmers, as promoters of improvement, that they cannot be accused of the desire of hoarding up riches through the love of gain, so long as they can improve the condition of their farms in any way, even though they themselves

may not ultimately reap the advantages arising from those improvements. Were draining an operation which could be executed at little cost and trouble, it would be of little importance to urge its accomplishment in the most effectual way; but as it is an expensive operation, when conducted even in the most economical manner, much thought is requisite before attempting to break up the ground to a great extent. A knowledge of the structure of the upper portion of the earth's crust is absolutely necessary to direct our thoughts aright on this subject. That knowledge may even now be partially acquired by any farmer. Let him therefore, in the first place, contemplate the facts it unfolds to his view, and endeavour through them to acquire that wisdom which will direct him to expend his money in draining with prudence as well as skill. It will assist him much in ascertaining what are the kinds of soil which require deep draining, and what kinds may be treated equally well under a different management. Inattention to this distinction has given rise to the inordinate application of a general principle, which, as a general principle, but subject to great and necessary limitations, must receive the approbation of every man who knows and feels the importance of this improvement in husbandry.

Much has already been effected in Great Britain, but much yet remains to be done, by draining. A vast extent of the arable land of England and Scotland, and we may more especially include Ireland, generally esteemed dry, is yet so far injured by the tardy and imperfect escape of the water, especially in winter, and during long periods of wet weather in summer, that the working of it is often difficult and precarious, and its fertility much below what would uniformly exist under a thorough dryness. A system of drainage, therefore, generally applicable, and effecting complete and uniform dryness, is of the utmost importance to the agricultural interest, and *through* them to every other interest in the country.

The advantages arising from draining land are both numerous and various. Manures and stimulants can never impart their peculiar benefits to any soil which rests continually on a wet bottom;—the operations of husbandry can never be accomplished in due season;—and the produce is never abundant or of good quality in such circumstances. Draining removes all these evils. It is truly an operation, as Pliny terms it, of the highest utility,—“*Humidiorem agrum fossis concidi atque siccari, utilissimum est*”;—it is not only the meliorator, but the maker of soil. Let no one despair of his soil, however forbidding; let him really drain it, and the results will encourage him.

The general improvement of the soil by draining would lower the value of high-rented land; but it would greatly increase the aggregate rental of the kingdom. It would diminish the general cost of produce, thereby affording cheaper provisions to the consumer. Both landlord and tenant would have greater returns from the land; and these returns being permanent, the landlord ought to bear the greatest share of the expense. Increased production would create a demand for labour, and the labourers of all professions would be enabled to live more comfortably. From this only true mode of cheapening labour, the British manufacturer would be aided in his competition with foreign labour;—the general revenue of the country would increase;—the salubrity of the climate, and the general beauty of the country, would be greatly promoted. There is no subject, therefore, more worthy the attention of the landed interest, than the encouragement of thorough drainage, and, as a necessary and beneficial consequence of draining, the deep working of the soil. (K. K. K.)

Drake.

DRAKE, SIR FRANCIS, a celebrated English admiral, was the son of Edmund Drake, a sailor, and was born near Tavistock, in Devonshire, in the year 1545. He was brought up at the expense and under the care of Sir John Hawkins, who was his kinsman, and, at the age of eighteen, was the purser of a ship trading to Biscay. At twenty he made a voyage to Guinea, and at twenty-two he was made captain of the *Judith*. In that capacity he was in the harbour of San Juan de Ulloa, in the Gulf of Mexico, where he behaved most gallantly in the actions under Sir John Hawkins, and returned with him to England, having acquired great reputation, though not worth a groat. Upon this he projected an attack against the Spaniards in the West Indies; a project which he no sooner published than he found volunteers enow ready to accompany him. In 1570 he undertook an expedition with two ships, and the next year with only one, in which he returned safe, if not with such advantages as he had expected. In 1572 he made another expedition, in which he did the Spaniards some mischief, and gained considerable booty. In these expeditions he was much assisted by a nation of Indians, who were then engaged in a sort of chronic warfare with the Spaniards. The prince of these people was named Pedro, to whom Drake presented a fine cutlass from his side, which he saw the Indian greatly admired. Pedro, in return, gave him four large wedges of gold; which Drake threw into the common stock, saying that he thought it but just that such as on his credit bore the charge of so uncertain a voyage, should share the utmost advantage which that voyage produced. Then having embarked his men with all the wealth he had obtained, which was very considerable, he bore away for England, where he arrived in August 1573.

His success in this expedition, joined to his honourable behaviour towards his owners, gained him high reputation, and the use which he made of his riches a still higher. Having fitted out three frigates at his own expense, he sailed with them to Ireland; and there, under Walter earl of Essex, the father of the famous but unfortunate earl, he served as a volunteer, and performed many glorious actions. After the death of his patron, he returned to England, where Sir Christopher Hatton introduced him to her majesty Queen Elizabeth, and procured him countenance and protection at court. By this means he acquired the means of undertaking that grand expedition which has rendered his name immortal. The first proposal he made was to undertake a voyage into the South Seas through the Straits of Magelhaens; an achievement which no Englishman had hitherto ever attempted. This project having been well received at court, the queen furnished him with means; and his own fame quickly drew together a sufficient force. The fleet with which he sailed on this enterprise consisted only of five vessels, small when compared with the size of modern ships, and having on board no more than a hundred and sixty-four able men. Having sailed on the 13th of December 1577, he on the 25th fell in with the coast of Barbary, and on the 29th with Cape Verde. On the 18th of March he passed the equinoctial, made the coast of Brazil on the 5th of April, and entered the river Plata, where he parted company with two of his ships; but having met them again, and taken out their provisions, he turned them adrift. On the 29th of May he entered the port of St Julian's, where he continued two months for the sake of laying in a stock of provisions. On the 20th of August he entered the Straits of Magelhaens, and on the 25th of September passed them, having then only his own ship. On the 25th of November he arrived at Macao, which he had appointed as the place of rendezvous in the event of his ships being separated; but Captain Winter, his vice-admiral,

having repassed the straits, had returned to England. He thence continued his voyage along the coast of Chili and Peru, taking all opportunities of seizing Spanish ships, and attacking them on shore, till his men were satiated with plunder; and then, coasting America to the height of forty-eight degrees, he endeavoured to find a passage that way back into the Atlantic, but could not, because none exists. However, he landed, and called the country *New Albion*, taking possession of it in the name and for the use of Queen Elizabeth; and having careened his ship, he set sail from thence on the 29th September 1579, for the Moluccas. He is supposed to have chosen this passage round, partly to avoid being attacked by the Spaniards at a disadvantage, and partly because, from the lateness of the season, dangerous storms and hurricanes were apprehended. On the 13th of October he fell in with certain islands inhabited by the most barbarous people he had met with in all his voyage. On the 4th of November he got sight of the Moluccas; and, arriving at Ternate, was extremely well received by the king of that place, who appears from the most authentic relations of this voyage to have been a wise and politic prince. On the 10th of December he made the Celebes, where his ship unfortunately struck upon a rock on the 9th of January following; but, beyond all expectation, they got her off, and continued their course. On the 16th of March he arrived at Java, whence he intended to have directed his course to Malacca; but he found himself obliged to alter his purpose, and to think of returning home. On the 25th of March 1580, he put this design in execution; and on the 15th of June he doubled the Cape of Good Hope, having then on board only fifty-seven men and three casks of water. On the 12th of July he passed the line, reached the coast of Guinea on the 16th, and there watered. On the 11th of September he made the island of Terceira, and on the 3d of November he entered the harbour of Plymouth. This voyage round the world was performed in two years and about ten months. Shortly after his arrival, the queen having gone to Deptford, went on board his ship, and there, after dinner, conferred upon him the honour of knighthood, at the same time declaring her entire approbation of all that he had done. She likewise gave directions for the preservation of his ship, that it might remain a monument of his own and his country's glory. In the year 1585, he sailed with a fleet to the West Indies, and took the cities of St Jago, St Domingo, Carthagena, and St Augustine. In 1587 he went to Lisbon with a fleet of thirty sail; and having received intelligence of a great fleet being assembled in the bay of Cadiz, and destined to form part of the armada, he with great courage entered the port, and there burnt upwards of 10,000 tons of shipping; a feat which he afterwards merrily called "burning the king of Spain's beard." In 1588, when the Spanish armada was approaching our shores, Sir Francis Drake was appointed vice-admiral under Charles Lord Howard of Effingham, high-admiral of England; and here fortune favoured him as remarkably as ever; for he made prize of a very large galleon, commanded by Don Pedro de Valdez, who was reputed the projector of the invasion. This affair deserves to be particularly stated. On the 22d of July, Sir Francis observing a great Spanish ship floating at a distance from both fleets, sent his pinnace to summon the commander to yield. Valdez replied, with much Spanish solemnity, that they were four hundred and fifty strong, that he himself was Don Pedro, and stood much upon his honour; and thereupon propounded several conditions, upon which he was willing to yield. But the vice-admiral replied, that he had no leisure to parley; that if the Don thought fit instantly to yield, he might; if not, he should soon find that Drake

Drake.

Drama. was no coward. Pedro, hearing the name of Drake, immediately yielded, and with forty-six of his attendants came on board the admiral's ship. This Don Pedro remained about two years Sir Francis Drake's prisoner in England; and when he was released, paid for his own and his captain's liberty a ransom of L.3500. Drake's soldiers were well recompensed with the plunder of this ship, for they found in it 55,000 ducats of gold, which were divided amongst them.

A little before this formidable Spanish armament put to sea, the ambassador of his Catholic majesty had the confidence to propose to Queen Elizabeth, in Latin verse, the terms upon which she might hope for peace. The lines embodying this singular diplomatic communication are as follow:

Te veto ne pergas bello defendere Belgas;
Quæ Dracus eripuit nunc restituantur oportet:
Quas pater evertit jubeo te condere cellas:
Religio Papæ fac restituatur ad unguem.

To these the queen made this extempore response:

Ad Græcas, bone rex, fiant mandata kalendas.

In the year 1559, Sir Francis Drake commanded the fleet sent to restore Dom Antonio, king of Portugal, the land forces being under the orders of Sir John Norris; but they had hardly put to sea when the commanders differed, and thus the attempt proved abortive. But as the war with Spain continued, a more formidable expedition was fitted out, under Sir John Hawkins and Sir Francis Drake, against their settlements in the West Indies, than had hitherto been undertaken during the whole course of it. Here, however, the commanders again disagreed about the plan; and the result in like manner disappointed public expectation. Before these two last expeditions, all difficulties had given way to the skill and fortune of Sir Francis Drake; and this probably was the reason why he did not bear these disappointments so well as he might otherwise have done. A strong sense of them is supposed to have thrown him into a melancholy, which occasioned a bloody flux, of which he died on board his own ship, near the town of Nombre de Dios, in the West Indies, on the 28th of January 1595-96. His death was lamented by the whole nation, and particularly by his countrymen, who had great reason to love him from the correctness of his private life, as well as to esteem him on account of his public character. He was elected burgess for the town of Bossiny, otherwise called Tintagal, in the county of Cornwall, in the twenty-seventh parliament of Queen Elizabeth; and for Plymouth, in Devonshire, in the thirty-fifth of the

same reign. This town was under very particular obligations to him; for, in the year 1587, he undertook to bring into it water, from want of which it had till then been grievously distressed; and he performed this undertaking by conducting thither a stream from springs at eight miles distance, but by a course of upwards of twenty miles.

DRAKENBORCH, **ARNOLD**, a celebrated scholar and editor, was a native of Utrecht, where he was born on the 1st of January 1684; and in that city he was afterwards professor of rhetoric and history, an office which he filled with great reputation. Grævius and Burmann taught him the belles lettres, and Cornelius Van Eck was his preceptor whilst he devoted his attention to the law. He succeeded Professor Burmann in the year 1716, and terminated his mortal career in 1748, in the sixty-fourth year of his age. He was an author of distinguished eminence, as his publications sufficiently evince. His dissertation entitled *Disputatio philologico-historica de Præfecto urbis*, in 4to, proves him to have been an able philologist, and gave flattering indications of future eminence. Its intrinsic merit caused it to be reprinted at Frankfort, in 1752, by Professor Uhl, accompanied with a life of its learned author. His next work, entitled *Disputatio de officio præfectorum prætorio*, was published in the year 1707; and ten years afterwards he gave to the world his edition of *Silius Italicus*, in seventeen books, 4to. In order to render this edition as perfect as possible, nothing was omitted; and many historical subjects were engraved for the purpose of elucidating the text, to which his own copious and learned annotations greatly contributed. But his splendid edition of Livy, with a life of that eminent historian, is that on which his fame as a scholar chiefly rests. It is entitled *T. Livii Patavini historiarum ab urbe condita libri, qui supersunt, omnes*. Lugd. Batav. 1738 and 1746, 7 tom. The preface to this work is very long, and replete with erudition, giving a particular account of all the literary characters who have at different periods commented on the works of Livy. He took the edition of Gronovius as his model, because in his estimation it was the most correct; but he made many important alterations on the authority of manuscripts which it is probable Gronovius had either never seen, or not taken the pains to consult. Upon the whole, this edition of Livy is at once the most elaborate, interesting, and instructive, ever given to the world, since he has introduced into it the criticisms of Duchier, Gronovius, Perizonius, and Sigonius, in addition to his own, which, though somewhat prolix, are certainly fraught with much literature and deep discernment.

**Draken-
borch
||
Drama.**

D R A M A.

A **DRAMA** (we adopt Dr Johnson's definition, with some little extension) is a poem or fictitious composition in dialogue, in which the action is not related, but represented.

A disposition to this fascinating amusement, considered in its rudest state, seems to be inherent in human nature. It is the earliest sport of children to take upon themselves some fictitious character, and sustain it to the best of their skill, by such appropriate gesture and language as their youthful fancies suggest, and such dress and decoration as circumstances place within their reach. The infancy of nations is as prone to this pastime as that of individuals. When the horde emerges out of a nearly brutal state, so far as to have holidays, public sports, and general rejoicings, the pageant of their imaginary deities, or of their fabulous ancestors, is usually introduced as the most

pleasing and interesting part of the show. But however general the predisposition to the assumption of fictitious character may be, there is an immeasurable distance betwixt the rude games in which it first displays itself, and that polished amusement which is numbered among the fine arts, which poetry, music, and painting have vied to adorn, and to whose service genius has devoted her most sublime efforts; whilst philosophy has stooped from her loftier task, to regulate the progress of the action, and give probability to the representation and personification of the scene.

The history of Greece—of that wonderful country, whose Outline. days of glory have left such a never-dying blaze of radiance behind them—the history of Greece affords us the means of correctly tracing the polished and regulated drama, the subject of severe rule, and the vehicle for ex-

Drama.

pressing the noblest poetry, from amusements as rude in their outline as the mimic sports of children or of savages. The history of the Grecian stage is that of the dramatic art in general. They transferred the drama, with their other literature, to the victorious Romans, with whom it rather existed as a foreign than flourished as a native art. Like the other fine arts, the stage sunk under the decay of the empire, and its fall was accelerated by the introduction of the Christian religion. In the middle ages dramatic representation revived, in the shape of the homely Mysteries and Moralities of our forefathers. The revival of letters threw light upon the scenic art, by making us acquainted with the pitch of perfection to which it had been carried by the genius of Greece. With this period commences the history of the modern stage, properly so called. Some general observations on the drama, and its present state in Britain, will form a natural conclusion to the article.

Rise of the Grecian drama.

The account which we have of the origin of Grecian theatrical representations, describes them as the fantastic orgies of shepherds and peasants, who solemnized the rites of Bacchus by the sacrifice of a goat, by tumultuous dances, and by a sort of masquerade, in which the actors were disguised like the ancient *Morrice-dancers* of England, or the *Guisards* of Scotland, who have not as yet totally disused similar revels. Instead of masks, their faces were stained with the lees of wine, and the songs and jests corresponded in coarseness to the character of the satyrs and fawns, which they were supposed to assume in honour of their patron Bacchus. Music, however, always formed a part of this rude festivity, and to this was sometimes added the recitations of an individual performer, who, possessed of more voice or talent than his companions, was able to entertain an audience for a few minutes by his own individual exertions.

Out of such rude materials, Thespis is supposed to have been the first who framed something like an approach to a more regular entertainment. The actors under this, the first of theatrical managers, instead of running about wild among the audience, were exalted upon a cart, or upon a scaffold formed of boards laid upon tressels. In these improvements Thespis is supposed to have had the aid of one Susarion, whose efforts were more particularly directed to the comic drama. But their fortunes have been unequal, for whilst the name of Thespis is still united with every thing dramatic, that of Susarion has fallen into oblivion, and is only known to antiquaries.

The drama in Greece, as afterwards in Britain, had scarcely begun to develop itself from barbarism, ere, with the most rapid strides, it advanced towards perfection. Thespis and Susarion flourished about four hundred and forty or fifty years before the Christian era. The battle of Marathon was fought in the year 490 before Christ; and it was upon Æschylus, one of the Athenian generals on that memorable occasion, that Greece conferred the honoured title of the Father of Tragedy. We must necessarily judge of his efforts by that which he did, not by that which he left undone; and if some of his regulations may sound strange in modern ears, it is but just to compare the state in which he found the drama, with that in which he left it.

Æschylus was the first, who, availing himself of the invention of a stage by Thespis, introduced upon the boards a plurality of actors at the same time, and converted into action and dialogue, accompanied or relieved at intervals by the musical performance of the chorus, the dull monologue of the Thespian orator. It was Æschylus, also, who introduced the deceptions of scenery, stationary indeed, and therefore very different from the decorations of our

stage, but still giving a reality to the whole performance, which could not fail to afford pleasure to those who beheld for the first time an effort to surround the player, while invested with his theatrical character, with scenery which might add to the illusions of the representations. But this was not all. A theatre, at first of wood, but afterwards of stone, circumscribed, whilst it accommodated, the spectators, and reduced a casual and disorderly mob to the quality and civilization of a regular and attentive audience.

The most remarkable effect of the tragedy of Æschylus was the introduction of the chorus in a new character, which continued long to give a peculiar tone to the Grecian drama, and to make a striking difference betwixt that original theatre and those which have since arisen in modern nations.

The chorus who sung hymns in favour of Bacchus, the musical part, in short, of the entertainment, remained in the days of Thespis, as it had been in the rude village gambols which he had improved, the principal part of the dramatic entertainment. The intervention of monologue, or recitation, was merely a relief to the musicians and a variety to the audience. Æschylus, whilst he assigned a part of superior consequence to the actor in his improved dialogue, new-modelled the chorus, which custom still enjoined as a necessary and indispensable branch of the performance. They were no longer a body of vocal musicians, whose strains were as independent of what was spoken by the personages of the drama, as those of our modern orchestra when performing betwixt the acts. The chorus assumed from this time a different and complicated character, which forms a marked peculiarity in the Grecian drama, distinguishing it from the theatrical compositions of modern Europe.

The chorus, according to this new model, was composed of a certain set of persons, priests, captive virgins, matrons, or others, usually of a solemn and sacred character, the contemporaries of the heroes who appeared on the stage, who remained upon the scene to celebrate in hymns set to music the events which had befallen the active persons of the drama; to afford them alternately their advice or their sympathy; and, at least, to moralize, in lyrical poetry, on the feelings to which their history and adventures, their passions and sufferings, gave rise. The chorus might be considered as, in some degree, the representatives of the audience, or rather of the public, on whose great stage those events happen in reality which are presented in the mimicry of the drama. In the strains of the chorus, the actual audience had those feelings suggested to them as if by reflection in a mirror, which the events of the scene ought to produce in their own bosom; they had at once before them the action of the piece, and the effect of that action upon a chosen band of persons, who, like themselves, were passive spectators, whose dignified strains pointed out the moral reflections to which the subject naturally gave rise. The chorus were led or directed by a single person of their number, termed the coryphæus, who frequently spoke or sung alone. They were occasionally divided into two bands, who addressed and replied to each other. But they always preserved the character proper to them, of spectators, rather than agents in the drama.

The number of the chorus varied at different periods, often extending to fifty persons, and sometimes restricted to half that number; but it is evident that the presence of so many persons on the scene, officiating as no part of the *dramatis personæ*, but rather as contemporary spectators, involved many inconveniences and inconsistencies. That which the hero, however agitated by passion, must naturally have suppressed within his own breast, or uttered in soliloquy, was thus necessarily committed to the

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Drama. confidence of fifty people, less or more. And when a deed of violence was to be committed, the helpless chorus, instead of interfering to prevent the atrocity to which the perpetrator had made them privy, could only, by the rules of the theatre, exhaust their sorrow and surprise in dithyrambics. But still the union which Æschylus accomplished betwixt the didactic hymns of the chorus and the events which were passing upon the stage, was a most important improvement upon the earlier drama. By this means the two unconnected branches of the old Bacchanalian revels were combined together; and we ought rather to be surprised that Æschylus ventured, whilst accomplishing such an union, to render the hymns sung by the chorus subordinate to the action or dialogue, than that he did not take the bolder measure of altogether discarding that which, before his time, was reckoned the principal object of a religious entertainment.

Grecian
theatre,
and mode
of acting.

The new theatre and stage of Athens were reared, as we have seen, under the inspection of Æschylus. He also introduced dresses in character for his principal actors, to which were added embellishments of a kind which mark the wide distinction betwixt the ancient and modern stage. The personal disguise which had formerly been attained by staining the actor's face, was now, by what doubtless was considered as a high exertion of ingenuity, accomplished by the use of a mask, so painted as to represent the personage whom he performed. To augment the apparent awkwardness of this contrivance, the mouths of these masks were frequently fashioned like the extremity of a trumpet, which, if it aided the actor's voice to reach the extremity of the huge circuit to which he addressed himself, must still have made a ridiculous appearance upon the stage, had not the habits and expectations of the spectators been in a different tone from those of a modern audience. The use of the *cothurnus* or buskin, which was contrived so as to give to the performer additional and unnatural stature, would have fallen under the same censure. But the ancient and modern theatres may be said to resemble each other only in name, as will appear from the following account of the Grecian stage, abridged from the best antiquaries.

The theatres of the Greeks were immensely large in comparison to ours; and the audience sat upon rows of benches, rising above each other in due gradation. In form they resembled a horse-shoe. The stage occupied a platform, which closed in the flat end of the building, and was raised so high as to be on a level with the lowest row of benches. The central part of the theatre, or what we call the pit, instead of being filled with spectators, according to modern custom, was left for the occasional occupation of the chorus, during those parts of their duty which did not require them to be nearer to the stage. This space was called the *orchestra*, and corresponded in some measure with the open space which, in the modern equestrian amphitheatres, is interposed betwixt the audience and the stage, for the display of feats of horsemanship. The delusion of the scene being thus removed to a considerable distance from the eye of the spectator, was heightened; and many of the objections offered to the use of the mask and the buskin were lessened or totally removed. When the chorus did not occupy the orchestra, they ranged themselves beside the *thymele*, a sort of altar, surrounded with steps, placed in front of their stage orchestra. From this, as a post of observation, they watched the progress of the drama, and to this point the actors turned themselves when addressing them. The solemn hymns and mystic dances of the chorus, performed during their retreat into the orchestra, formed a sort of interludes, or interruptions of the action, similar in effect to the modern division into acts. But, properly speaking,

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there was no interruption of the representation from beginning to end. The piece was not, indeed, constantly progressive; but the illusion of the scene was always before the audience, either by means of the actors themselves or of the chorus. And the musical recitation and character of the dances traced by the chorus in their interludes, were always in correspondence with the character of the piece, grave, majestic, and melancholy; in tragedy, gay and lively; in comedy, and during the representation of satirical pieces, wild, extravagant, and bordering on buffoonery. The number of these interludes, or interruptions of the action, seems to have varied from three to six, or even more, at the pleasure of the author. The music was simple and inartificial, although it seems to have produced powerful effects on the audience. Two flute-players performed a prelude to the choral hymns, or directed the movement of the dances, which in tragedy were a solemn, slow, modulated succession of movements, very little resembling anything termed dancing among the moderns.

The stage itself was well contrived for the purposes of the Greek drama. The front was called the *logeum*, and occupied the full width of the flat termination of the theatre, contracted, however, at each extremity by a wall, which served to conceal the machinery necessary for the piece. The stage narrowed as it retired backwards; and the space so restricted in breadth was called the *proscenium*. It was terminated by a flat decoration, on which was represented the front of a temple, palace, or whatever else the poet had chosen for his scene. Suitable decorations appeared on the wings, as in our theatres. There were several entrances, both by the back scene and in front. These were not used indiscriminately, but so as to indicate the story of the piece, and render it more clear to apprehension. Thus, the persons of the drama who were supposed to belong to the palace or temple in the flat scene, entered from the side or the main door, as befitted their supposed rank; those who were inhabitants of the place represented, entered through a door placed at the side of the *logeum*; while those supposed to come from a distance were seen to traverse the orchestra, and to ascend the stage by a stair of communication, so that the audience were made spectators, as it were, of their journey. The proscenium was screened by a curtain, which was withdrawn when the piece commenced. The decorations could be in some degree altered, so as to change the scene; though this, we apprehend, was seldom practised. But machinery for the ascent of phantoms, the descent of deities, and similar exhibitions, were as much in fashion among the Greeks as on our own modern stage; with better reason, indeed, for we shall presently see that the themes which they held most proper to the stage called frequently for the assistance of these mechanical contrivances.

In the dress and costume of their personages the Greeks bestowed much trouble and expense. It was their object to disguise as much as possible the mortal actor who was to represent a divinity or an hero; and while they hid his face and augmented his height, they failed not to assign him a mask and dress in exact conformity to the popular idea of the character represented; so that, seen across the orchestra, he might appear the exact resemblance of Hercules or of Agamemnon.

The Grecians, but in particular the Athenians, became most passionately attached to the fascinating and splendid amusement which Æschylus thus regulated, which Sophocles and Euripides improved, and which all three, with other dramatists of inferior talents, animated by the full vigour of their genius. The delightful climate of Greece permitted the spectators to remain in the open air (for

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there was no roof to their huge theatres) for whole days, during which several plays, high monuments of poetical talent, were successively performed before them. The enthusiasm of their attention may be judged of by what happened during the representation of a piece written by Hegemon. It was while the Athenians were thus engaged that there suddenly arrived the astounding intelligence of the total defeat of their army before Syracuse. The theatre was filled with the relations of those who had fallen; there was scarcely a spectator, who, besides sorrowing as a patriot, was not called to mourn a friend or relative. But, spreading their mantles before their faces, they commanded the representation to proceed; and thus veiled, continued to give it their attention to the conclusion. National pride, doubtless, had its share in this singular conduct, as well as fondness for the dramatic art. Another instance is given of the nature and acuteness of their feelings, when the assembly of the people amerced Phrynichus in a fine of a thousand drachmæ, because, in a comedy founded upon the siege of Miletos, he had agitated their feelings to excess, in painting an incident which Athens lamented as a misfortune dishonourable to her arms and her councils.

The price of admission was at first one *drachma*; but Pericles, desirous of propitiating the ordinary class of citizens, caused the entrance-money to be lowered to two *oboli*, so that the meanest Athenian had the ready means of indulging in this luxurious mental banquet. As it became difficult to support the expense of the stage, for which such cheap terms of admission could form no adequate fund, the same statesman, by an indulgence yet more perilous, caused the deficiency to be supplied from the treasure destined to sustain the expense of the war. It is a sufficient proof of the devotion of the Athenians to the stage, that not even the eloquence of Demosthenes could tempt them to forego this pernicious system. He touched upon the evil in two of his orations; but the Athenians were resolved not to forego the benefits of an abuse which they were aware could not be justified, and they passed a law making it death to touch upon that article of reformation.

It must not be forgotten, that the Grecian audience enjoyed the exercise of critical authority, as well as of classical amusement, at their theatre. They applauded and censured, as at the present day, by clapping hands and hissing. Their suffrage at those tragedies acted upon the solemn feasts of Bacchus, adjudged a laurel crown to the most successful dramatic author. This faculty was frequently abused; but the public, on sober reflection, seldom failed to be ashamed of such acts of injustice, and faithful, upon the whole, to the rules of criticism, evinced a fineness and correctness of judgment, which never descended to the populace of any other nation.

Peculiar
character
of the Gre-
cian drama.

To this general account of the Grecian stage, it is proper to add some remarks on those peculiar circumstances from which it derives a tone and character so different from that of the modern drama; circumstances affecting at once its style of action, mode of decoration, and general effect on the feelings of the spectators.

The Grecian drama, it must be remembered, derived its origin from a religious ceremony; and, amid all its refinement, never lost its devotional character, unless it shall be judged to have done so in the department of satirical comedy.

When the audience was assembled, they underwent a religious lustration, and the archons or chief magistrates paid their public adoration to Bacchus, still regarded as the patron of the theatrical art, and whose altar was always placed in the theatre.

The subject of the drama was frequently religious. In

tragedy especially, Sophocles and Euripides, as well as Æschylus, selected their subjects from the exploits of the deities themselves, or of the demigods and heroes whom Greece accounted to draw an immediate descent from the denizens of Olympus, and to whom she paid nearly equal reverence. The object of the tragic poets was less to amuse and interest their audience by the history of the human heart, or soften them by the details of domestic distress, than to elevate them into a sense of devotion or submission, or to astound and terrify them by the history and actions of a race of beings before whom ordinary mortality dwindled into pigmy size. This they dared to attempt; and, what may appear still more astonishing to the mere English reader, this they appear in a great measure to have performed. Effects were produced upon their audience which we can only attribute to the awful impression communicated by the idea of the immediate presence of the divinity. The emotions excited by the apparition of the Eumenides or furies, in Æschylus's tragedy of that name, so appalled the audience that females are said to have lost the fruit of their womb, and children to have actually expired in convulsions of terror. These effects may have been exaggerated; but that considerable inconveniences occurred from the extreme horror with which this tragedy impressed the spectators, is evident from a decree of the magistrates, limiting the number of the chorus, in order to prevent in future such tragical consequences. It is plain that the feeling by which such impressions arose must have been something very different from what the spectacle of the scene alone could possibly have produced. The mere sight of actors disguised in masks, suited to express the terrific yet sublime features of an antique Medusa, with her hair entwined with serpents,—the wild and dishevelled appearance, the sable and bloody garments, the blazing torches, the whole apparatus, in short, or properties as they are technically called, with which the classic fancy of Æschylus could invest those terrific personages,—nay more, even the appropriate terrors of language and violence of gesture with which they were bodied forth, must still have fallen far short of the point which the poet certainly attained, had it not been for the intimate and solemn conviction of his audience that they were in the performance of an act of devotion, and to a certain degree in the presence of the deities themselves. It was this conviction, and the solemn and susceptible temper to which it exalted the minds of a large assembly, which prepared them to receive the electric shock produced by the visible representation of those terrible beings, to whom, whether as personifying the stings and terrors of an awakened conscience, or as mysterious and infernal divinities, the survivors of an elder race of deities, whose presence was supposed to strike awe even into Jove himself, the ancients ascribed the task of pursuing and punishing atrocious guilt.

It was in consistency with this connection betwixt the drama and religion of Greece, that the principal Grecian tragedians thought themselves entitled to produce upon the stage the most sacred events of their mythological history. It might have been thought that in doing so they injured the effect of their fable and action, since suspense and uncertainty, so essential to the interest of a play, could not be supposed to exist where the immortal gods, beings controlling all others, and themselves uncontrolled, were selected as the agents in the piece. But it must be remembered, that the synod of Olympus, from Jove downwards, were themselves but liminary deities, possessing indeed a certain influence upon human affairs, but unable to stem or divert the tide of fate or destiny, upon whose dark bosom, according to the Grecian creed, gods as well as men were embarked, and both sweeping downwards to

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Drama. some distant yet inevitable termination of the present system of the universe, which should annihilate at once the race of divinity and of mortality. This awful catastrophe is hinted at not very obscurely by Prometheus, who, when chained to his rock, exults, in his prophetic view, in the destruction of his oppressor Jupiter; and so far did Æschylus, in particular, carry the introduction of religious topics into his drama, that he escaped with some difficulty from an accusation of having betrayed the Eleusinian mysteries.

Where the subject of the drama was not actually taken from mythological history, and when the gods themselves did not enter upon the scene, the Grecian stage was, as we have already hinted, usually trod by beings scarcely less awful to the imagination of the audience; the heroes namely of their old traditional history, to whom they attributed an immediate descent from their deities, a frame of body and mind surpassing humanity, and after death an exaltation into the rank of demigods.

It must be added, that, even when the action was laid among a less dignified set of personages, still the altar was present on the stage; incense frequently smoked; and frequent prayers and obtestations of the deity reminded the audience that the sports of the ancient theatre had their origin in religious observances. It is scarcely necessary to state how widely the classical drama, in this respect, differs in principle from that of the modern, which pretends to be nothing more than an elegant branch of the fine arts, whose end is attained when it supplies an evening's amusement, whose lessons are only of a moral description, and which is so far from possessing a religious character, that it has with difficulty escaped condemnation as a profane, dissolute, and antichristian pastime. From this difference of principle there flows a difference of practical results, serving to account for many circumstances which might otherwise seem embarrassing.

The ancients, we have seen, endeavoured by every means in their power, including the use of masks and of buskins, to disguise the person of the actor; and, at the expense of sacrificing the expression of his countenance, and the grace, or at least the ease, of his form, they removed from the observation of the audience every association which could betray the person of an individual player, under the garb of the deity or hero he was designed to represent. To have done otherwise would have been held indecorous, if not profane. It follows, that as the object of the Athenian and of the modern auditor in attending the theatre was perfectly different, the pleasure which each derived from the representation had a distinct source. Thus, for example, the Englishman's desire to see a particular character is intimately connected with the idea of the actor by whom it is performed. He does not wish to see Hamlet in the abstract, so much as to see how Kemble performs that character,¹ and to compare him perhaps with his own recollections of Garrick in the same part. He comes prepared to study each variation of the actor's countenance, each change in his accentuation and deportment; to note with critical accuracy the points which discriminate his mode of acting from that of others; and to compare the whole with his own abstract of the character. The pleasure arising from this species of critical investigation and contrast is so intimately allied with our ideas of theatrical amusement, that we can scarce admit the possibility of deriving much satisfaction from a

Drama. representation sustained by an actor whose personal appearance and peculiar expression of features should be concealed from us, however splendid his declamation, or however appropriate his gesture and action. But this mode of considering the drama, and the delight which we derive from it, would have appeared to the Greeks a foolish and profane refinement, not very different in point of taste from the expedient of Snug the joiner, who intimated his identity by letting his natural visage be seen under the mask of the lion which he represented. It was with the direct purpose of concealing the features of the individual actor, as tending to destroy the effect of his theatrical disguise, that the mask and buskin were first invented, and afterwards retained in use. The figure was otherwise so dressed as to represent the deity or demigod, according to the statue best known, and adored with most devotion, by the Grecian public. The mask was, by artists who were eminent in the plastic art, so formed as to perfect the resemblance. Theseus or Hercules stood before the audience in the very form with which painters and statuaries had taught them to invest the hero, and there was certainly thus gained a more complete scenic deception than could have been obtained in our present mode. It was aided by the distance interposed betwixt the audience and the stage; but, above all, by the influence of enthusiasm acting upon the congregated thousands, whose imaginations, equally lively and susceptible, were prompt to receive the impressions which the noble verse of their authors conveyed to their ears, and the living personification of their gods and demigods placed before their eyes.

It is scarcely necessary to add, that, while these observations plead their apology for the mask and the buskin of the ancients, they leave, where it stood before, every objection to those awkward and unseemly disguises, considered in themselves, and without reference to the peculiar purpose and tendency of the ancient theatre. In fact, the exquisite pleasure derived from watching the eloquence of feature and eye, which we admire in an accomplished actor, was not, as some have supposed, sacrificed by the ancients for the assumption of these disguises. They never did, and, according to the plan of their theatres, never could, possess that source of enjoyment. The circuit of the theatre was immense, and the eyes of the thousands whom it contained were so far removed from the stage, that, far from being able to enjoy the minute play of the actor's features, the mask and buskin were necessary to give distinction to his figure, and to convey all which the ancients expected to see, his general resemblance, namely, to the character he represented.

The style of acting, so far as it has been described to us, corresponded to the other circumstances of the representation. It affected gravity and sublimity of movement and of declamation. Rapidity of motion and vivacity of action seem to have been reserved for occasions of particular emotion; and that delicacy of bye-play, as well as all the aid which look and slight jesture bring so happily to the aid of an impassioned dialogue, were foreign to their system. The actors, therefore, had an easier task than on the modern stage, since it is much more easy to preserve a tone of high and dignified declamation, than to follow out the whirlwind and tempest of passion, in which it is demanded of the performer to be energetic without bombast, and natural without vulgarity.

The Grecian actors held a high rank in the republic,

¹ It is proper to state here, once for all, that, contrary to our usual practice, this article is reprinted as it originally appeared in the Supplement to the fourth, fifth, and sixth editions of this work, without any of those adaptations which the course of time and change of circumstances render necessary in ordinary cases. We have deemed this homage due to the genius and fame of the illustrious author (Sir Walter Scott), whose splendid view of the origin and progress of the dramatic art we have accordingly presented to the reader exactly as it proceeded from his own hand, leaving every contemporaneous allusion and illustration untouched.

Drama.

Principal
tragic
writers in
Athens.

and those esteemed in the profession were richly recompensed. Their art was the more dignified, because the poets themselves usually represented the principal character in their own pieces; a circumstance which corroborates what we have already stated concerning the comparative inferiority of talents required in a Grecian actor, who was only expected to move with grace and declaim with truth and justice. His disguise hid all personal imperfections; and thus a Grecian poet might aspire to become an actor without that extraordinary and unlikely union of moral and physical powers which would be necessary to qualify a modern dramatist to mount the stage in person, and excel at once as a poet and as an actor.

It is no part of our present object to enter into any minute examination of the comparative merits of the three great tragedians of Athens, Æschylus, Sophocles, and Euripides. Never, perhaps, did there arise, within so short a space, such a succession of brilliant talents. Sophocles might, indeed, be said to be the contemporary of both his rivals, for his youthful emulation was excited by the success of Æschylus, and the eminence of his latter years was disturbed by the rivalry of Euripides, whom, however, he survived. To Æschylus, who led the van in the dramatic enterprise, as he did in the field of Marathon, the sanction of antiquity has ascribed unrivalled powers over the realms of astonishment and terror. At his summons, the mysterious and tremendous volume of destiny, in which are inscribed the doom of gods and men, seemed to display its leaves of iron before the appalled spectators; the more than mortal voices of Deities, Titans, and departed Heroes, were heard in awful conference; heaven bowed, and its divinities descended; earth yawned, and gave up the pale spectres of the dead, and the yet more undefined and grisly forms of those infernal deities who struck horror into the gods themselves. All this could only be dared and done by a poet of the highest order, confident, during that early age of enthusiasm, that he addressed an audience prompt to kindle at the heroic scene which he placed before them. It followed almost naturally, from his character, that the dramas of Æschylus, though full of terrible interest, should be deficient in grace and softness; that his sublime conciseness should deviate sometimes into harshness and obscurity; that, finding it impossible to sustain himself at the height to which he had ascended, he should sometimes drop, "fluttering his pinions vain," into great inequalities of composition; and, finally, that his plots should appear rude and inartificial, contrasted with those of his successors in the dramatic art. Still, however, Æschylus led not only the way in the noble career of the Grecian drama, but outstripped, in point of sublimity at least, those by whom he was followed.

Sophocles, who obtained from his countrymen the title of the *Bee* of Attica, rivalled Æschylus when in the possession of the stage, and obtained the first prize. His success occasioned the veteran's retreat to Sicily, where he died, commanding that his epitaph should make mention of his share in the victory of Marathon, but should contain no allusion to his dramatic excellencies. His more fortunate rival judiciously avoided the dizzy and terrific path which Æschylus had trode with so firm and daring a step. It was the object of Sophocles to move sorrow and compassion, rather than to excite indignation and terror. He studied the progress of action with more attention than Æschylus, and excelled in that modulation of the story by which interest is excited at the beginning of a drama, maintained in its progress, and gratified at its conclusion. His subjects are also of a nature more melancholy and less sublime than those of his predecessor. He loved to paint heroes rather in their forlorn than in their triumph-

ant fortunes, aware that the contrast offered new sources of the pathetic to the author. Sophocles was the most fortunate of the Greek tragedians. He attained the age of ninety-one years; and, in his eightieth, to vindicate himself from a charge of mental imbecility, he read to the judges his *Œdipus Coloneus*, the most beautiful, at least the most perfect, of his tragedies. He survived Euripides, his most formidable rival, of whom also we must say a few words.

It is observed by Schlegel, that the tone of the tragedies of Euripides approaches more nearly to modern taste than to the stern simplicity of his predecessors. The passion of love predominates in his pieces, and he is the first tragedian who paid tribute to the passion which has been too exclusively made the moving cause of interest on the modern stage,—the first who sacrificed to

Cupid, king of gods and men.

The dramatic use of this passion has been purified in modern times, by the introduction of that tone of sentiment which, since the age of chivalry, has been a principal ingredient in heroic affection. This was unknown to the ancients, in whose society females, generally speaking, held a low and degraded place, from which few individuals emerged, unless those who aspired to the talents and virtues proper to the masculine sex. Women were not forbidden to become competitors for the laurel or oaken crown offered to genius and to patriotism; but antiquity held out no myrtle wreath as a prize for the domestic virtues peculiar to the female character. Love, therefore, in Euripides, does not always breathe purity of sentiment, but is stained with the mixture of violent and degrading passions. This, however, was the fault of the age rather than of the poet, although he is generally represented as an enemy of the female sex; and his death was ascribed to a judgment of Venus.

When blood-hounds met him by the way,
And monsters made the bard their prey.

This great dramatist was less happy than Sophocles in the construction of his plots; and, instead of the happy expedients by which his predecessor introduces us to the business of the drama, he had too often recourse to the mediation of a prologue, which came forth to explain in detail the previous history necessary to understand the piece.

Euripides is also accused of having degraded the character of his personages, by admitting more alloy of human weakness, folly, and vice, than was consistent with the high qualities of the heroic age. Æschylus, it was said, transported his audience into a new and more sublime race of beings; Sophocles painted mankind as they ought to be, and Euripides as they actually are. Yet the variety of character introduced by the latter tragedian, and the interest of his tragedies, must always attract the modern reader, coloured as they are by a tone of sentiment, and by his knowledge of the actual business, rules, and habits of actual life, to which his predecessors, living, as they did, in an imaginary and heroic world of their own, appear to have been strangers. And although the judgment of the ancients assigned the pre-eminence in tragedy to Æschylus or Sophocles, yet Euripides has been found more popular with posterity than either of his two great predecessors.

The division betwixt tragedy and comedy, for both sprung from the same common origin, the feasts, namely, in honour of Bacchus, and the disguises adopted by his worshippers, seems to have taken place gradually, until the jests and frolics, which made a principal part of these revels, were found misplaced when introduced with graver mat-

Drama.

Grecian
comedy.

Drama. ter, and were made by Susarion, perhaps, the subject of a separate province of the drama. The Grecian comedy was divided into the ancient, the middle, and the modern style of composition.

Ancient comedy.

The ancient and original comedy was of a kind which may, at first sight, appear to derogate from the religious purposes which we have pointed out as the foundation of the drama. They frequently turn upon parodies, in which the persons and adventures of those gods and heroes who were the sublime subjects of the tragic drama, are introduced for the purpose of buffoon-sport and ridicule, as in Carey's modern farces of *Midas* and the *Golden Pippin*. Hercules appears in one of those pieces astonishing his host by an extravagant appetite, which the cook in vain attempts to satiate, by placing before him, in succession, all the various dishes which the ancient kitchen afforded. In another comedy, Bacchus, in whose honour the solemnity was instituted, is brought in only in order to ridicule his extreme cowardice.

At other times, allowing a grotesque fancy its wildest range, the early comic authors introduced upon the stage animals, and even inanimate things, as part of their *dramatis personæ*, and embodied forth on the stage the fantastic imaginations of Lucian in his *True History*. The golden age was represented in the same ridiculous and bizarre mode of description as the *Pays de la Cocagne* of the French minstrels, or the popular ideas of *Lubber-land* in England; and the poets furnished kingdoms of birds, and worlds, in the moon.

Had the only charm of these entertainments consisted in the fantastic display with which the eyes of the spectators were regaled at the expense of the over-excited imagination of the poet, they would soon have fallen into disuse; for the Athenians were too acute and judicious critics to have been long gratified with mere extravagance. But these grotesque scenes were made the medium for throwing the most bold and daring ridicule upon the measures of the state, upon the opinions of individuals, and upon the religion of the country.

This propensity to turn into ridicule that which is most serious and sacred, had probably its origin in the rude gambols of the sylvan deities who accompanied Bacchus, and to whose petulant and lively demeanour rude jest was a natural accompaniment. The audience, at least the more ignorant part of them, saw these parodies with pleasure, which equalled the awe they felt at the performance of the tragedies, whose most solemn subjects were thus burlesqued; nor do they appear to have been checked by any sense that their mirth was profane. In fact, when the religion of a nation comes to consist chiefly in the practice of a few unmeaning ceremonies, it is often found that the populace, with whatever inconsistency, assume the liberty of profaning them by grotesque parodies, without losing their reverence for the superstitions which they thus vilify. Customs of a like tendency were common in the middle ages. The festival of the Ass in France, of the Boy-Bishop in England, of the Abbot of Unreason in Scotland, and many other popular practices of the same kind, exhibited, in countries yet Catholic, daring parodies of the most sacred services and ceremonies of the Roman church. And as these were practised openly, and under authority, without being supposed to shake the people's attachment to the rites which they thus ridiculed, we cannot wonder that similar profanities were well received among the Pagans, whose religion sat very loosely upon them, and who professed no fixed or necessary articles of faith.

It is probable that, had the old Grecian comedy continued to direct its shafts of ridicule only against the inhabitants of Olympus, it would not have attracted the coer-

cion of the magistracy. But its province was far more extensive, the poets claiming the privilege of laying their opinions on public affairs before the people in this shape. Cratinus, Eupolis, and particularly Aristophanes, a daring, powerful, and apparently unprincipled writer, converted comedy into an engine for assailing the credit and character of private individuals, as well as the persons and political measures of those who administered the state. The doctrines of philosophy, the power of the magistrate, the genius of the poet, the rites proper to the deity, were alternately made the subject of the most uncompromising and severe satire. It was soon discovered that the more directly personal the assault could be made, and the more revered or exalted the personage, the greater was the malignant satisfaction of the audience, who loved to see wisdom, authority, and religious reverence brought down to their own level, and made subjects of ridicule by the powers of the merciless satirist. The use of the mask enabled Aristophanes to render his satire yet more pointedly personal; for, by forming it so as to imitate, probably with some absurd exaggeration, the features of the object of his ridicule, and by imitating the dress and manner of the original, the player stepped upon the stage a walking and speaking caricature of the hero of the night, and was usually placed in some ludicrous position, amidst the fanciful and whimsical chimeras with which the scene was peopled.

In this manner Aristophanes ridiculed with equal freedom Socrates, the wisest of the Athenians, and Cleon, the demagogue, when at the height of his power. As no one durst perform the latter part, for fear of giving offence to one so powerful, the author acted Cleon himself, with his face smeared with the lees of wine. Like the satire of Rabelais, the political and personal invective of Aristophanes was mingled with a plentiful allowance of scurril and indecent jests, which were calculated to insure a favourable reception from the bulk of the people. He resembles Rabelais also in the wild and fanciful fictions which he assumes as the vehicle of his satire; and his comedy of the *Birds* may even have given hints to Swift, when, in order to contrast the order of existing institutions with those of an Utopian and fantastic fairy land, he carries Gulliver among giants and pigmies. Yet though his indecency, and the offensive and indiscriminate scurrility of his satire, deserve censure;—though he merits the blame of the wise for his attack upon Socrates, and of the learned for his repeated and envenomed assaults on Euripides,—Aristophanes has nevertheless added one deathless name to the deathless period in which he flourished; and, from the richness of his fancy, and gaiety of his tone, has deserved the title of the Father of Comedy. When the style of his sarcasm possessed the rareness of novelty, it was considered of so much importance to the state, that a crown of olive was voted to the poet, as one who had taught Athens the defects of her public men. But unless angels were to write satires, ridicule cannot be considered as the test of truth. The temptation to be witty is just so much the more resistless, that the author knows he will get no thanks for suppressing the jest which rises to his pen. As the public becomes used to this new and piquant fare, fresh characters must be sacrificed for its gratification. Recrimination adds commonly to the contest, and those who were at first ridiculed out of mere wantonness of wit, are soon persecuted for resenting the ill usage; until literature resembles an actual personal conflict, where the victory is borne away by the strongest and most savage, who deals the most desperate wounds with the least sympathy for the feeling of his adversary.

The ancient comedy was of a character too licentious to be long tolerated. Two or three decrees having been

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in vain passed, in order to protect the citizens against libels of this poignant description, the ancient comedy was finally proscribed by that oligarchy which assumed the government of Athens upon the downfall of the popular government towards the end of the Peloponnesian war. By order of these rulers, Anaxander, an actor, was punished capitally for parodying a line of Euripides, so as to infer a slight of the government. He was starved to death, to which, as an appropriate punishment, the public has since his time often indirectly condemned both actors and dramatists. Aristophanes, who was still alive, bowed to the storm, and relinquished the critical and satirical scourge which he had hitherto exercised in the combined capacity of satirist, reformer, and reviewer; and the use of the chorus was prohibited to comic actors, as it seems to have been in their stanzas chiefly that the offensive satire was invested. To this edict Horace alludes in the well known lines:

Successit vetus his comœdia, non sine multa
Laude: sed in vitium libertas excidit, et vim
Dignam lege regi. lex est accepta, chorusque
Turpiter obticuit, sublato jure nocendi.¹

Middle
comedy.

In the middle comedy, Thalia and her votaries seemed to have retraced their steps, and, avoiding personal satire, resorted once more to general subjects of burlesque railery. We learn from history, real or fabulous, or from the works of the elder poets, that these plays had the fanciful wildness without the personal satire of the ancient comedy; for the authors were obliged to take care that there was no "offence" in their pleasantry. At most, they only ventured to touch on matters of instant interest in the way of inuendo, under feigned titles and oblique hints, and had no longer the audacity to join men's vices or follies to their names. Aristophanes re-cast several of his pieces in this manner. But the same food, without the poignant seasoning to which the audience had been accustomed, palled on their taste, and this cast of pieces soon gave place to that which the ancients called the New Comedy, so successfully cultivated by Menander and others.

New co-
medy.

Notwithstanding what modern critics have said to the contrary, and particularly the ingenious Schlegel, the new tone which comedy thus assumed seems more congenial to true taste as well as to public decorum, and even to the peace and security of the community, than that of Aristophanes, whose satiric wit, like a furious bull, charged upon his countrymen without respect or distinction, and tossed and gored whatever he met with in his way.

The new comedy had for its object the ludicrous incidents of private life (*celebrare domestica facta*, says Horace); to detail those foibles, follies, and whimsical accidents, which are circumstances material and serious to the agents themselves, but, as very usually happens on the stage of the world, matters only of ludicrous interest to the on-lookers. The new comedy admitted also many incidents of a character not purely ludicrous, and some which, calling forth pathetic emotion, approached more nearly to the character of tragedy than had been admitted in the ancient comedies of Aristophanes, and in this rather resembled what the French have called *Tragédie Bourgeoise*. It is scarce necessary to remark, that the line cannot be always distinctly drawn betwixt the subjects which excite mirth and those which call forth sympathy. It often hap-

pens that the same incident is at once affecting and ludicrous, or admits of being presented alternately in either point of view. In a drama, also, which treats of the faults and lighter vices, as well as of the follies of mankind, it is natural that the author should sometimes assume the high tone of the moralist. In these cases, to use the language of Horace, comedy exalts her voice, and the offended father, the pantaloon of the piece, swells into sublimity of language. A pleasant species of composition was thus attained, in which wit and humour were relieved by touches both of sentiment and moral instruction. The new comedy, taken in this enlarged point of view, formed the introduction to the modern drama; but it was neither so comprehensive in its plan, nor so various in character and interest.

The form which the Greeks, and in imitation of them the Romans, adopted, for embodying their comic effusions, was neither extended nor artificial. To avoid the charge of assaulting, or perhaps the temptation to attack private persons, the actors in their drama were rather painted as personifications of particular classes of society, than living individual characters. The list of these personages was sufficiently meagre. The principal character, upon whose devices and ingenuity the whole plot usually turns, is the *Geta* of the piece, a witty, roguish, insinuating, and malignant slave, the confidant of a wild and extravagant son, whom he aids in his pious endeavours to cheat a suspicious, severe, and griping father. When to these three are added a wily courtesan, a procuress, a stolen virgin, who is generally a mute or nearly such, we have all the stock-characters which are proper to the classic comedy. Upon this limited scale of notes the ancients rung their changes, relieving them occasionally, however, by the introduction of a boastful soldier, a boorish clown, or a mild and good-natured old man, to contrast with the irascible Chremes of the piece, the more ordinary representative of old age.

The plot is in general as simple as the cast of the characters. A father loses his child, who falls into the hands of a procuress or slave merchant. The efforts of the youth, who falls in love with this captive, to ransom her from her captivity, are seconded by the slave, who aids him in the various devices necessary to extort from his father the funds necessary for the purchase, and their tricks form the principal part of the intrigue. When it is necessary that the play shall close, the discovery of the girl's birth takes place, and the young couple are married. The plots are indeed sometimes extended or enlarged by additional circumstances, but very seldom by any novelty of character or variety of general form.

It is a necessary consequence, that the ancient comic authors were confined within a very narrow compass. The vast and inexhaustible variety of knavery, folly, affectation, humour, &c. as mingled with each other, or as modified by difference of age, sex, temper, education, profession, and habit of body, are all within the royalty of the modern comic dramatist, and he may summon them up, under what limitations and in what circumstances he pleases, to play their parts in his piece. The ancients were much more limited in their circle of materials, and, perhaps, we must look for the ruling cause once more in the great size of their theatres, and to the use of the mask, which, though it easily presented the general or generic character of the personage introduced, was inca-

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General
character
of the new
comedy.

¹ The ancient comedy next play'd its part,
Well-famed, at first, for spirit and for art:
But Liberty o'erleaping decent awe,
Satiric rage required restraint from law;
The edict spoke, dishonour'd silence bound
The chorus, and forbade their ancient right to wound.

Drama. pable of the endless variety which can be given to ridicule of a more minute, refined, and personal kind, by the flexible organs of a modern actor.

But besides this powerful reason for refraining from any attempt to draw characters distinguished by peculiar habits, there is much reason to think that the mode of life pursued by the ancient Athenians was unfavourable to the formation of whimsical, original, or eccentric characters. Citizens of the same state, they lived much together, and the differences of ranks did not make the same distinction in taste and manners as in modern Europe. Their occupation, also, was the same. They were all public men, and had a common interest in the management of the state; and it probably followed that, in men whose pursuits were all bent the same way, the same general similarity of manners might be found to exist, which is remarked in those who follow the same profession. The differences of youth and age, of riches and poverty, of good or bad temper, &c. must have been much modified in Attica, where all free citizens were, to a certain degree, on a level—discussed the same topics of state, and gave the same vote to forward them—enjoyed, without restriction, the same public amusements; and where the same general cast of manners might descend to the lowest of the citizens, for the very reason that even a poor herb-woman understood the delicacy of the Attic dialect so perfectly, as to distinguish a stranger by the first words he addressed to her.

The chorus, silenced, as we have seen, owing to the license of the old comedy, made no appendage to that which was substituted in its place. The exhibition of the Grecian comedy did not, in other respects, in so far as we know, materially differ from that of the tragedy. Instead of the choral interludes, the representation was now divided, by intervals of cessation, into acts, as upon the modern stage. And the number five seems to have been fixed upon as the most convenient and best adapted for the purposes of representation. The plot, as we have seen, and the distinct and discriminated specification of character, were, in either case, subordinate considerations to the force of style and composition. It follows, of consequence, that we can better understand and enjoy the tragedies than the comedies of the ancients. The circumstances which excite sublime or terrific sensations are the same, notwithstanding the difference of age, country, and language. But comic humour is of a character much more evanescent. The force of wit depends almost entirely upon time, circumstance, and manners, insomuch that a jest which raises inextinguishable laughter in a particular class of society, appears flat or disgusting if uttered in another. It is, therefore, no wonder that the ancient comedy, turning upon manners so far removed from our own time, should appear to us rather dull and inartificial. The nature of the intercourse between the sexes in classic times was also unfavourable for comedy. The coquette, the fine lady, the romp, all those various shades of the female character which occupy so many pleasant scenes on the modern stage, were totally unknown to ancient manners. The wife of the ancient comedy was a mere household drudge, the vassal, not the companion, of an imperious husband. The young woman whose beauty is the acting motive of the intrigue, never evinces the slightest intellectual property of any kind. And the only female character admitting of some vivacity is that of the courtesan, whose wit as well as her charms appeared to have been professional.

After subtracting the large field afforded by female art or caprice, female wit, or folly, or affection, the realm of the ancient comedy will appear much circumscribed; and we have yet to estimate a large deduction to be made on

account of the rust of antiquity, and the total change of religion and manners. It is no wonder, therefore, that the wit of Plautus and Terence should come forth diminished in weight and substance, after having been subjected to the alembic of modern criticism. That which survives the investigation, however, is of a solid and valuable character. If these dramas do not entertain us with a display of the specific varieties of character, they often convey maxims evincing a deep knowledge of human passion and feeling; and are so admirably adapted to express, in few and pithy words, truths which it is important to remember, that even the Apostle Paul himself has not disdained to quote a passage from a Grecian dramatist. The situation, also, of their personages is often truly comic; and the modern writers who have borrowed their ideas, and arranged them according to the taste of their own age, have often been indebted to the ancients for the principal cause of their success.

Having dwelt thus long upon the Grecian drama, we Roman are entitled to treat with conciseness that of Rome, which, drama. like the other fine arts, that people, rather martial than literary, copied from their more ingenious neighbours.

The Romans were not, indeed, without a sort of rude dramatic representation of their own, of the same nature with that which, as we have already noticed, usually arises in an early period of society. These were called *Fabulae Atellane*; farces, for such they were, which took their name from *Atella*, a town belonging to the *Osci*, in Italy. They were performed by the Roman youth, who used to attack each other with satirical couplets during the intervals of some rude game, in which they seem to have represented the characters of fabulous antiquity. But, 361 years before the Christian era, the Romans, in the time of a great pestilence, as we learn from Livy, introduced a more regular species of theatrical entertainment, in order to propitiate the deities by a solemn exhibition of public games; after which, what had hitherto been matter of mere frolic and amusement, assumed, according to the historian, the appearance of a professional art; and the Roman youth, who had hitherto appeared as amateur performers, gave up the stage to regular performers.

These plays continued, however, to be of a very rude structure, until the Grecian stage was transplanted to Rome. Livius Andronicus, by birth a Grecian, led the way in this improvement, and is accounted her first dramatist.

Seneca the philosopher is the only Roman tragedian whose works have reached our time. But his tragedies afford no very favourable specimen of Roman art. They are in the false taste which succeeded the age of Augustus, and debased the style of composition in that of Nero; bombastic, tedious, and pedantic; treating, indeed, of Grecian subjects, but not with Grecian art.

By a singular contrast, although we have lost the more valuable tragedies of Rome, we have been compelled to judge of the new Greek comedy through the medium of the Latin translations. Of Menander we have but a few fragments, and our examples of his drama are derived exclusively from Plautus and Terence. Of these, the former appears the more original, the latter the more elegant author. The comedies of Plautus are much more connected with manners, much more full of what may be termed drollery and comic situation, and are believed to possess a greater portion of Roman character. The Romans, indeed, had two species of comedy, the *Palliata*, where the scene and dress were Grecian; the *Togata*, where both were Roman. But besides this distinction, even the *Mantled*, or Grecian comedy, might be more or less of a Roman cast; and Plautus is supposed to have

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infused a much stronger national tone into his plays than can be traced in those of Terence. They are also of a ruder cast, and more extravagant, retaining, perhaps, a larger portion of the rough horse-play peculiar to the *Fabulae Atellanæ*. Terence, on the contrary, is elegant, refined, and sententious; decorous and regular in the construction of his plots; exhibiting more of wit in his dialogue, than of comic force in his situations; grave often and moral, sometimes even pathetic; and furnishing, upon the whole, the most perfect specimens of the Grecian comedy, both in action and character.

The alterations which the Romans made in the practice of the theatrical art do not seem to have been of great consequence. One circumstance, however, deserves notice. The orchestra, or, as we should say, the pit of the theatre, was no longer left vacant for the occasional occupation of the chorus, but was filled with the senators, knights, and other more respectable citizens. The stage was thus brought more near to the eye of the higher class of the audience. It would also seem that the theatres were smaller; for we read of two so constructed that each turned upon a pivot, so that, when placed back to back, they were separate theatres, yet were capable of being wheeled round, with all the audience, so as to bring their oblong ends together, then forming a single amphitheatre, in which the games of the circus succeeded to dramatic representation. It is not easy to conceive the existence of such machinery; but the story, at any rate, seems to show that their theatres must have been greatly smaller than those of Greece, to admit the supposition of such an evolution as being in any degree practicable. This diminution in the size of the house, and the occupation of the orchestra by the most dignified part of the audience, may have afforded a reason why masks were, at least occasionally, disused on the Roman stage. That they were sometimes disused is certain; for Cicero mentions Roscius Gallus as using a mask to conceal a deformity arising from the inequality of his eyes, which implies plainly that other comedians played with their faces disclosed. It is therefore probable that the imperfections of the mask were felt so soon as the distance was diminished between the performer and the spectators; and we may hazard a conjecture that this disguise was first laid aside in the smaller theatres.

Degradation of the theatrical profession.

But the principal change introduced by the Romans into the drama, and which continues to affect it in every country of Europe, respected the *status* or rank of the actors in society. We have seen that Athens, enthusiastic in her attachment to the fine arts, held no circumstances degrading which were connected with them. Æschylus and Sophocles were soldiers and statesmen, yet lost nothing in the opinion of their countrymen by appearing on the public stage. Euripides, who was also a person of consequence, proved that "love esteems no office mean;" for he danced in a female disguise in his own drama, and that not as the Princess Nauticlea, but as one of her handmaidens, or, in modern phrase, as a *figurante*. The Grecians, therefore, attached no dishonour to the person of the actor, nor esteemed that he who contributed to giving the amusement of the theatre was at all degraded beneath those who received it. It was otherwise in Rome. The contempt which the Romans entertained for players might be founded partly upon their confounding this elegant amusement with the games of the circus and amphitheatre, performed by gladiators and slaves, the meanest, in short, of mankind. Hence, to use the words of St Augustine, "the ancient Romans, accounting the art of stage-playing and the whole scene infamous, ordained that this sort of men should not only want the honour of other citizens, but also be disfranchised and thrust out of their

tribe, by a legal and disgraceful censure, which the censors were to execute; because they would not suffer their vulgar sort of people, much less their senators, to be defamed, disgraced, or defiled with stage-players;" which act of theirs he styles "an excellent true Roman prudence, to be enumerated among the Romans' praises."

Accordingly, an edict of the prætor stigmatized as infamous all who appeared on the stage, either to speak or act; but it is remarkable that from this general proscription the Roman youth were excepted; and they continued to enact the *Fabulae Atellanæ*, namely, the farces or drolleries of ancient Italian origin, without incurring any stigma. This exception seems to indicate that the edict originated in the national pride of the Romans, and their contempt for Grecian literature, and for foreigners of every description. Under any other view it is impossible they should have preferred the actors in these coarse farces, who, by the bye, are supposed to have been the originals of no less persons than Harlequin and Punchinello, to those who possessed taste and talents sufficient to execute the masterly scenes borrowed from the Grecian drama.

Injustice, however, and we call that law unjust which devotes to general infamy any profession of which it nevertheless tolerates the practice, is usually inconsistent. Several individual play-actors in Rome rose to high public esteem, and to the enjoyment of great wealth. Roscius was the friend and companion of Piso and of Sylla, and, what was still more to his credit, of Cicero himself, who thus eulogises the scenic art, while commemorating the merit of his deceased friend: *Quis nostrum tam animo agresti ac duro fuit, ut Roscii morte nuper non commoveretur? qui quum esset senex mortuus, tamen, propter excellentem artem ac venustatem, videbatur omnino mori non debuisset.*

Paris, another Roman actor, reached a height of celebrity as distinguished as Roscius, and exercised, as many of his profession have since done, an arbitrary authority over the unfortunate dramatic authors. It is recorded by the satirist that Statius the epic poet might have starved had he not given up to this favourite of the public, upon his own terms doubtless, the manuscript of an unacted performance. Paris was put to death by Domitian out of jealousy.

If the actors rose to be persons of importance in Rome, the dramatic critics were no less so. They had formed a code of laws for the regulation of dramatic authors, to which the great names of Aristotle and Horace both contributed their authority. But these will be more properly treated of when we come to mention their adoption by the French stage.

Having thus hastily given some account of the ancient stage, from its rise in Greece to its transportation to Rome, we have only to notice the circumstances under which it expired.

Christianity from its first origin was inimical to the institution of the theatre. The fathers of the church inveigh against the profaneness and immodesty of the theatre. In the treatise of Tertullian, *De Spectaculis*, he has written expressly upon the subject. The various authorities on this head have been collected and quoted by the enemies of the stage, from Prynne down to Collier. It ought, however, to be noticed, that their exprobration of the theatre is founded, first, upon its origin, as connected with heathen superstition; and secondly, on the beastly and abominable license practised in the pantomimes, which, although they made no part of the regular drama, were presented nevertheless in the same place, and before the same audience. "We avoid your shows and games," says Tertullian, "be-

Drama.

Decay and disrepute of the ancient stage.

Drama. cause we doubt the warrant of their origin. They savour of superstition and idolatry, and we dislike the entertainment, as abhorring the heathen religion on which it is founded." In another place he observes, the temples were united to theatres, in order that superstition might patronize debauchery; and that they were dedicated to Bacchus and to Venus, the confederate deities of lust and intemperance.

It was not only the connection of the theatre with heathen superstition that offended the primitive church, but also the profligacy of some of the entertainments which were exhibited. There cannot be much objected to the regular Roman dramas in this particular, since even Mr Collier allows them to be more decorous than the British stage of his own time; but, as we have already hinted, in the *Ludi Scenici*, the intrigues of the gods and the heroes were represented upon the stage with the utmost grossness. These obscene and scandalous performances thus far coincided with the drama, that they were acted in the same theatres, and in honour of the same deities, and both were subjected to the same sweeping condemnation. They were not, however, absolutely or formally abolished, even when Christianity became the religion of the state. Tertullian and St Augustin both speak of the scenic representations of their own day, under the distinct characters of tragedy and comedy; and although condemned by the church, and abhorred by the more strict Christians, there is little doubt that the ancient theatre continued to exist until it was buried under the ruins of the Roman empire.

MODERN DRAMA.

Dramatic representations of the middle ages.

The same proneness to fictitious personification, which we have remarked as a propensity common to all countries, introduced, during the dark ages, a rude species of drama into most of the nations of Europe. Like the first efforts of the ancients in that art, it had its foundation in religion; with this great difference, that as the rites of Bacchus before, and even after the improvements introduced by Thespis, were well enough suited to the worship of such a deity, the religious dramas, mysteries, or whatever other name they assumed, were often so unworthy of the Christian religion, on which they were founded, that their being tolerated can be attributed only to the gross ignorance of the laity, and the cunning of the Catholic priesthood, who used them, with other idle and sometimes indecorous solemnities, as one means of amusing the people's minds, and detaining them in contented bondage to their spiritual superiors.

In the empire of the East, religious exhibitions of a theatrical character appear to have been instituted about the year 990, by Theophylact, patriarch of Constantinople, with the intention, as Warton surmises, of weaning the minds of the people from the Pagan revels, by substituting Christian spectacles, partaking of the same spirit of license. His contemporaries give him little credit for his good intentions. "Theophylact," says Cedrenus, as translated by Warton, "introduced the practice, which prevails to this day, of scandalizing God and the memory of his saints, on the most splendid and popular festivals, by indecent and ridiculous songs, and enormous shoutings, even in the midst of those sacred hymns which we ought to offer to divine grace for the salvation of our souls. But he having collected a company of base fellows, and placing over them one Euthynicus, surnamed Casnes, whom he also appointed the superintendent of his church, admitted into the sacred service diabolical dances, exclamations of ribaldry, and ballads borrowed from the streets and brothels." The irregularities of the Greek clergy, who, on certain holidays, personated feigned characters, and entered even the choir in masquerade, are elsewhere mentioned. (Warton's

History of English Poetry, vol. ii. p. 370.) These passages do not prove that actual mysteries or sacred dramas were enacted on such occasions; but probably the indecent revels alluded to bore the same relation to such representations, as the original rites of Bacchus to the more refined exhibitions of Thespis and Susarion.

There has been some dispute among theatrical antiquaries, in which country of Europe dramatic representations of a religious kind first appeared. The liberal and ingenious editor of the *Chester Mysteries* has well remarked, in his introduction to that curious and beautiful volume, that a difficulty must always attend the inquiry, from the doubts that exist, whether the earliest recorded performances of each country were merely pantomimes, or were accompanied with dialogue.

The practice of processions and pageants with music, in which characters, chiefly of sacred writ, were presented before the public, is so immediately connected with that of speaking exhibitions, that it is difficult to discriminate the one from the other.

We are tempted to look first to Italy; as it is natural that the tragic art should have revived in that country in which it was last exercised, and where traditions, and perhaps some faint traces, of its existence were still preserved.

"The first speaking sacred drama," says Mr Walker, "was *Della Passione di nostro Signor Giesù Christo*, by Giuliano Dati, bishop of San Leo, who flourished about the year 1445." (Walker's *Essay on the Revival of the Drama in Italy*, p. 6.) This elegant author does, indeed, show that Italian scholars, and particularly Mussato, the Paduan historian, had composed two Latin dramas upon something like the classical model about the year 1300. Yet, although his play upon the tyranny and death of Ezzolino obtained him both reputation and honour, it does not appear to have been composed for the stage, but rather to have been a dramatic poem, since the progress of the piece is often interrupted by the poet speaking in his own person.

The French drama is traced by M. Legrand as high as the thirteenth century; and he has produced one curious example of a pastoral entitled *Un Jeu*. He mentions also a farce, two devotional pieces, and two moralities, to each of which he ascribes the same title. It may be suspected that these are only dialogues recited by the travelling minstrels and troubadours, such as Petrarch acknowledges having sometimes composed for the benefit of the strolling musicians. Such were probably the spectacles exhibited by Philip the Fair in 1313, on account of the honour of knighthood conferred on his children. Ricoboni, anxious for the honour of Italy, denies to these amusements the character of a legitimate drama; with what justice we have no information that can enable us to decide.

Amidst this uncertainty, it is not unpleasant to record the fair claim which Britain possesses to be one of the earliest, if not the very first nation in which dramatic representation seems to have been revived. The *Chester Mysteries*, called the *Whitsun Plays*, appear to have been performed during the mayoralty of John Arneway, who filled that office in Chester from 1268 to 1276. The very curious specimen of these mysteries, which has been of late printed for private distribution by Mr Markland of the Temple, furnishes us with the banes or proclamation, containing the history and character of the pageants which it announces.

Reverende lordes and ladyes all,
That at this tyme here assembled bee,
By this message understande you shall,
That sometymes there was mayor of this citie,

Drama.

Sir John Arnway, Knyghte, who most worthilye
Contented hymselfe to sett out an playe
The devise of one Done Rondali, moonke of Chester Abbey.

This moonke, moonke-like in scriptures well seene,
In storyes travelled with the best sorte;
In pagentes set fourth, apparently to all eyne,
The Olde and Newe Testament with livelye comforte;
Intermynglinge therewith, onely to make sporte,
Some things not warranted by any writt,
Which to gladd the hearers he woulde men to take yt.

This matter he abrevited into playes twenty-foure,
And every playe of the matter gave but a taste,
Leavinge for better learninge scircumstances to accomlishe,
For his proceedinges maye appeare to be in haste:
Yet all together unprofitable his labour he did not waste,
For at this daye, and ever, he deserveth the fame
Which all monkes deserves professinge that name.

This worthy Knihte Arnway, then mayor of this citie,
This order toke, as declare to you I shall,
That by twentye-fower occupations, artes, craftes, or misteries,
These pagentes shoulde be played after breeffe rehearsall;
For every pagente a cariage to be provyded withall,
In which sorte we purpose this Whitsontyde,
Our pageants into three partes to devyde.

I. Now you worshippingfull TANNERS that of custome olde
The fall of Lucifer did set out,
Some writers awarrante your matter, therefore be boulde
Lustelye to playe the same to all the rowtte:
And yf any thereof stand in any doubte.
Your author his author hath, your shewe let bee,
Good speech, fyne players, with apparill comelye.

Chester Mysteries.

Such were the celebrated Mysteries of Chester. To Mr Markland's extracts from them is prefixed a curious dissertation upon their age and author. They were so highly popular, as to be ranked, in the estimation of the vulgar, with the ballads of Robin Hood; for a character in one of the old moralities is introduced as boasting,

I can rhimes of Robin Hood, and Randal of Chester,
But of our Lord and our Lady I can nought at all.

The poetical value of these mysteries is never considerable, though they are to be found among the dramatic antiquities of all parts of Europe. It was, however, soon discovered that the purity of the Christian religion was inconsistent with these rude games, in which passages from scripture were profanely and indecently mingled with human inventions of a very rude, and sometimes an indecorous character. To the Mysteries, therefore, succeeded the Moralities, a species of dramatic exercise, which involved more art and ingenuity, and was besides much more proper for a public amusement, than the imitations or rather parodies of sacred history, which had hitherto entertained the public.

Moralities.

These Moralities bear some analogy to the old or original comedy of the ancients. They were often founded upon allegorical subjects, and almost always bore a close and poignant allusion to the incidents of the day. Public reformation was their avowed object, and, of course, satire was frequently the implement which they employed. Dr Percy, however, remarks that they were of two characters, serious and ludicrous; the one approaching to the tragedy, the other to the comedy of classical times; so that they brought taste as it were to the threshold of the real drama. The difference between the Catholic and reformed religion was fiercely disputed in some of these dramas; and in Scotland, in particular, a mortal blow was aimed at the superstitions of the Roman church, by the celebrated Sir David Lindsay, in a play or morality acted in 1539, and entitled *The Satire of the Three Estates*. The objects of this drama were entirely political, although it is mixed

with some comic scenes, and introduced by an interlude, in coarseness altogether unmatched. The spirit of Aristophanes, in all its good and evil, seems to have actuated the Scottish king-at-arms. It is a singular proof of the liberty allowed to such representations at the period, that James V. and his queen repeatedly witnessed a piece, in which the corruptions of the existing government and religion were treated with such satirical severity. The play, as acted, seems to have differed in some respects from the state in which it exists in manuscript.

In a letter to the Lord Privy Seal of England, dated 26th January 1540, Sir William Eure (envoy from Henry VIII.) gives the following account of the play, as it had then been performed "in the feast of Ephipanie at Lightgowe, before the king, queene, and the whole counsaile, spirituall and temporall. In the firste entres come in SOLACE (whose parte was but to make mery, sing ballets with his fellowes, and drinke at the interluydes of the play), whoe showed firste to all the audience the play to be played. Next come in a king, who passed to his throne, having nae speche to thende of the play, and then to ratify and approve, as in parliament, all things done by the rest of the players, which represented THE THREE ESTATES. With hym came his cortiers, PLACEBO, PICTHANK, and FLATTERYE, and sic alike gard; one swering he was the lustiest, starkeste, best proportionit, and most valyeant man that ever was; ane other swere he was the beste with long-bowe, crosse-bowe, and culverin, and so fourth. Thairafter there come a man armed in harness, with a swerde drawn in his hande, a BUSHOP, a BURGEMAN, and EXPERIENCE, clede like a DOCTOR; who set them all down on the deis under the KING. After them come a POOR MAN, who did go up and down the scaffolde, making a hevie complainte that he was hereyet, throw the courtiers taking his fewe in one place, and his tacks in another; wherthrough he had sceyled his house, his wyfe and childrene beggyng thair brede, and so of many thousands in Scotland; saying thair was no remedy to be gotten, as he was neither acquainted with controller nor treasurer. And then he looked to the king, and said he was not king in Scotland, for there was ane other king in Scotland that hanged JOHNE ARMSTRANG, with his fellowes, SYM THE LAIRD, and mony other mae; but he had lefte ane thing undone. Then he made a long narracione of the oppression of the poor, by the taking of the corse-presaunte beists, and of the herrying of poor men by the consistorye lawe, and of many other abusions of the SPIRITUALITIE and Church. Then the BUSHOP raise and rebuked him. Then the MAN OF ARMES alledged the contraire, and commanded the poor man to go on. The poor man proceeds with a long list of the bishop's evil practices, the vices of cloisters, &c. This is proved by EXPERIENCE, who, from a New Testament, shows the office of a bushop. The MAN OF ARMES and the BURGES approve of all that was said against the clergy, and alledge the expediency of a reform, with the consent of parliament. The BUSHOP dissents. The MAN OF ARMES and the BURGES said they were two, and he but one, wherefore their voice should have most effect. Thereafter the king, in the play, ratified, approved, and confirmed all that was rehersed."

The other nations of Europe, as well as England, had their mysteries and moralities. In France, Boileau, following Menestrier, imputes the introduction of these spectacles to travelling bands of pilgrims.

Chez nos dévots ayeux, le théâtre abhorré
Fut long-temps dans la France un plaisir ignoré;
Des pèlerins dit-on, une troupe grossière
En public à Paris y monta la première;
Et sottement zélée en sa simplicité
Joua les saints, la Vierge, et Dieu par piété.

L'Art Poétique, chant. iii.

Drama.

Drama.

In Spain the *Autos Sacramentales*, which are analogous to the mysteries of the middle ages, are still presented without shocking a nation whose zeal is stronger than their taste; and, it is believed, such rude and wild plays, founded on scripture, are also occasionally acted in Flanders. In the *History of the Council of Constance*, we find that mysteries were introduced into Germany by the English, about 1417, and were first performed to welcome the Emperor Sigismund, on his return from England; and, from the choice of the subjects, we should almost suppose that they had transferred to that country the *Chester Mysteries* themselves. "Les Anglois," says the historian, "se signalèrent entre les autres par un spectacle nouveau, ou au moins inusité jusques alors en Allemagne. Ce fut une comédie sacrée, que les évêques Anglois firent représenter devant l'empereur, le Dimanche 31 de Janvier, sur la Naissance du Sauveur, sur l'Arrivée des Mages, et sur la Massacre des Innocens." (*Hist. du Concile de Constance*, par L'Enfant, lib. v.) The character of these rude dramatic essays renders them rather subjects for the antiquary than a part of a history of the regular dramatic art.

Latin plays.

We may also pass over, with brief notice, the Latin plays which, upon the revival of letters, many of the learned composed in express imitation of the ancient Grecian and Latin productions. We have mentioned those of Mussato, who was followed by the more celebrated Carraro, in the path which he had opened to fame. In other countries the same example was followed. These learned prolusions, however, were only addressed to persons of letters, then a very circumscribed circle, and, when acted at all, were presented at universities or courts on solemn public occasions. They form no step in the history of the drama, unless that, by familiarizing the learned with the form and rules of the ancient classical drama, they gradually paved the way for the adoption of the same regulations into the revived vernacular drama, and formed a division amongst the theatres of modern Europe, which has never yet been reconciled.

Historical plays.

While the learned laboured to revive the classical drama in all its purity, the public at large, to which the treasures of the learned languages were as a fountain sealed, became addicted to a species of representation which properly neither fell under the denomination of comedy or tragedy, but was named History or Historical Drama. Charles Verardo, who, about 1492, composed a drama of this sort, in Latin, upon the expulsion of the Moors from Granada, claims, for this production, a total emancipation from the rules of dramatic criticism.

Requirat autem nullus hic comœdiæ,
Leges ut observantur, aut tragediæ;
Agenda nempe est *historia* non *fabula*.

"Let none expect that in this piece the rules of comedy or of tragedy should be observed; we mean to act a history, not a fable." From this expression it would seem that, in a historical drama, the author did not think himself entitled to compress or alter the incidents as when the plot was fabulous, but was bound, to a certain extent, to conform to the actual course of events. In these histories, the poet embraced often the life and death of a monarch, or some other period of history, containing several years of actual time, which, nevertheless, were made to pass before the eyes of the audience during the two or three hours usually allotted for the action of a play. It is not to be supposed that, with so fair a field open before them, and the applause of the audience for their reward, the authors of these histories should long have confined themselves to the matter of fact contained in records. They speedily innovated or added to their dramatic chronicles without regard to the real history. To those who

plead for stage plays, that they elucidate and explain many dark and obscure histories, and fix the facts firmly in the minds of the audience, of which they had otherwise but an imperfect apprehension, the stern Prynne replies with great scorn, "that play-poets do not explain, but sophisticate and deform, good histories, with many false varnishes and playhouse fooleries;" and that "the histories are more accurately to be learned in the original authors who record them, than in derivative playhouse pamphlets, which corrupt them." (Prynne's *Histrio-Mastix*, p. 940.)

Drama.

The dramatic chronicles, therefore, were a field in which the genius of the poet laboured to supply, by character, sentiment, and incident, the meagre detail of the historian. They became so popular in England, that, during the short interval betwixt the revival of the stage and the appearance of Shakspeare, the most part of the English monarchs had lived and died upon the stage; and it is well known that almost all his historical plays were new written by him, upon the plan of old dramatic chronicles which already existed.

But the miscellaneous audience which crowded to the vernacular theatre at its revival in Europe, were of that rank and intellect which is apt to become tired of a serious subject, and to demand that a lamentable tragedy should be intermingled with very pleasant mirth. The poets, obliged to cater for all tastes, seldom failed to insert the humours of some comic character, that the low or grotesque scenes in which he was engaged might serve as a relief to the graver passages of the drama, and gratify the taste of those spectators who, like Christoforo Sly, tired until the fool came on the stage again. Hence Sir Philip Sidney's censure on these dramatists, "how all their plays be neither right tragedies nor right comedies, mingling kings with clowns; not because the matter so carrieth it, but to thrust in the clown, by head and shoulders, to play a part in magestical matters, with neither decency nor discretion, so that neither the admiration and commiseration, nor the right sportfulness, is by their mongrel tragi-comedy attained." (*Defence of Poesie*. Sidney's *Arcadia*, edit. 1627, p. 563.) "If we mark them well," he concludes, "funerals and hornpipes seldom match daintily together."

The historical plays led naturally into another class, Romantic which may be called Romantic Dramas, founded upon popular poems or fictitious narratives, as the former were on real history. Some of these were borrowed from foreign nations, ready dramatized to the hand of the borrower; others were founded on the plots which occurred in the almost innumerable novels and romances which we had made our own by translation. "I may boldly say it," says Gosson, a recreant play-wright, who attacked his former profession, "because I have seen it, that the *Palace of Pleasure*, the *Golden Asse*, the *Ethiopian History*, *Amadis of Fraunce*, the *Round Table*, *Bawdie Comedies in Latin, French, Italian, and Spanish*, have been thoroughly ransacked to furnish the playhouse in London." But it was not to be supposed that the authors would confine themselves to stricter rules in pieces founded upon Italian and Spanish novels, or upon romances of chivalry, than they had acted upon in the histories. Every circumstance which tended to loosen the reins of theatrical discipline in the one case, existed in the other; and, accordingly, comedies of intrigue, and tragedies of action and show, everywhere superseded, at least in popular estimation, the severe and simple model of the classical drama.

It happened that in England and Spain, in particular, the species of composition which was most independent of critical regulation was supported by the most bril-

Drama. liant display of genius. Lopez de Vega and Calderon rushed on the stage with their hasty and high-coloured, but glowing productions, fresh from the mint of imagination, and scorning that the cold art of criticism should weigh them in her balance. The taste of the Spaniards has been proverbially inclined to the wild, the romantic, and the chivalrous; and the audience of their bards would not have parted with one striking scene, however inartificially introduced, to have gained for their favourites the praise of Aristotle and all his commentators. Lopez de Vega himself was not ignorant of critical rules; but he pleads the taste of his countrymen as an apology for neglecting those restrictions which he had observed in his earlier studies.

Yet true it is I too have written plays,
The wiser few, who judge with skill, might praise;
But when I see how show and nonsense draws
The crowds, and, more than all, the fair's applause;
Who still are forward with indulgent rage
To sanction every monster of the stage;
I, doom'd to write the public taste to hit,
Resume the barbarous dress 'twas vain to quit;
I lock up every rule before I write,
Plautus and Terence banish from my sight,
Lest rage should teach these injured wits to join,
And their dumb books cry shame on works like mine.
To vulgar standards, then, I frame my play,
Writing at ease, for, since the public pay,
'Tis just, methinks, we by their compass steer,
And write the nonsense that they love to hear.

Lord Holland's *Life of Lope de Vega*, p. 103.

The Spanish comedies of intrigue also went astray, as far as their romantic tragedies, from the classical path. In fact, these new representations were infinitely more captivating from their vivacity, novelty, and, above all, from their reflecting the actual spirit of the time, and holding the mirror up to nature, than the cold imitations which the learned wrote in emulation of the classic drama. The one class are existing and living pictures of the times in which the authors lived; the others, the cold resurrection of the lifeless corpses which had long slumbered in the tomb of antiquity. The spirit of chivalry, which so long lingered in Spain, breathes through the wild and often extravagant genius of her poets. The hero is brave and loyal, and true to his mistress:

A knight of love who never broke a vow.

Lovers of this description, in whose minds the sexual passion is sublimated into high and romantic feeling, make a noble contrast with the coarse and licentious Greek or Roman, whose passion turns only on the difficulty of purchasing his mistress's person, but who never conceives the slightest apprehension concerning the state of her affections.

That the crowd might have their loud laugh, a *grazioso* or clown, usually a servant of the hero, is in the Spanish drama uniformly introduced to make sport. Like Kemp or Tarletun, famous in the clown's part before the time of Shakspeare, this personage was permitted to fill up his part with extemporary jesting, not only on the performers, but with the audience. This irregularity, with others, seems to have been borrowed by the English stage from that of Spain, and is the license which Hamlet condemns in his instructions to the players: "And let those that be your clowns speak no more than is set down for them; for there be of them that will themselves laugh, to set on some quantity of barren spectators to laugh too, though, in the mean time, some necessary question of the play be then to be considered; that's villainous, and shows a most pitiful ambition in the fool that uses it."

The bald simplicity of the ancient plots was, in like

manner, contrasted to disadvantage with the intricacies, involutions, suspense, and bustle of Spanish intrigue upon the stage. Hence the boast of one of their poets, thus translated by Lord Holland:

Invention, interest, sprightly turns in plays,
Say what they will, are Spain's peculiar praise;
Her's are the plots which strict attention seize,
Full of intrigue, and yet disclosed with ease.
Hence acts and scenes her fertile stage affords,
Unknown, unrivall'd, on the foreign boards.

Life of Lope de Vega, p. 106.

While we admire the richness of fancy displayed in the Spanish pieces, it is impossible, in an age of refinement, to avoid being shocked by their wilful and extravagant neglect of every thing which can add probability to the action of their drama. But the apology for this license is well pleaded by Lord Holland.

"Without dwelling on the expulsion of the chorus (a most unnatural and inconvenient machine), the moderns, by admitting a complication of plot, have introduced a greater variety of incidents and character. The province of invention is enlarged; new passions, or at least new forms of the same passions, are brought within the scope of dramatic poetry. Fresh sources of interest are opened, and additional powers of imagination called into activity. Can we then deny what extends its jurisdiction, and enhances its interest, to be an improvement in an art whose professed object is to stir the passions by the imitation of human actions? In saying this I do not mean to justify the breach of decorum, the neglect of probability, the anachronisms, and other extravagancies of the founders of the modern theatre. Because the first disciples of the school were not models of perfection, it does not follow that the fundamental maxims were defective. The rudeness of their workmanship is no proof of the inferiority of the material; nor does the want of skill deprive them of the merit of having discovered the mine. The faults objected to them form no necessary part of the system they introduced. Their followers in every country have either completely corrected or gradually reformed such abuses. Those who bow not implicitly to the authority of Aristotle, yet avoid such violent outrages as are common in our early plays. And those who pique themselves on the strict observance of his laws, betray, in the conduct, the sentiments, the characters, and the dialogue of their pieces (especially of their comedies), more resemblance to the modern than the ancient theatre; their code may be Grecian, but their manners, in spite of themselves, are Spanish, English, or French. They may renounce their pedigree, and even change their dress, but they cannot divest their features of a certain family-likeness to their poetical progenitors."

In France the irregularities of the revived drama were of a lower complexion; for, until her stage was refined by Corneille, and brought under its present strict *regime*, it was adorned by but little talent; a circumstance which, amongst others, may account for the ease with which she subjected herself to critical rules, and assumed the yoke of Aristotle. Until she assumed the Grecian forms and restrictions, there is but little interesting in the history of her stage.

England adopted the historical and romantic drama with ardour, and in a state scarce more limited by rules than that of Spain herself. Her writers seem early to have ransacked Spanish literature; for the union of the countries during the short reign of Mary, nay even their wars under Elizabeth and Philip, made them acquainted with each other. The Spaniards had the start in the revival of the drama. *Ferrex and Perrex*, our earliest tragedy, was first presented in 1561; and *Gammer Gurton's*

Drama.

Drama. *Needle*, our first comedy, in 1575; whereas Lopez de Vega, who was not by any means the earliest Spanish dramatist, died in 1562, leaving the stage stocked with his innumerable productions, to which his contemporaries had not failed to add their share. Thus, as soon as the stage of Britain was so far advanced as to be in a capacity of borrowing, that of Spain offered a fund to which her authors could have recourse; and, in fact, the Spanish drama continued to be a mine in which the British poets collected materials, often without acknowledgment, during all the earlier part of her dramatic history. From this source, as well as from the partialities of the audience, arose that early attempt at show and spectacle, at combats and marvellous incidents, which, though with very poor means of representation, our early dramatic poets loved to produce at the Bull or the Fortune playhouses. The extravagance of their plots, and the poor efforts by which our early dramatists endeavoured to represent show and procession, did not escape the censure of Sir Philip Sidney, who, leaning to the critical reformation which was already taking place in Italy, would gladly have seen our stage reduced to a more classical model.

"It is faultie," says that gallant knight, "both in place and time, the two necessarie companions of all corporall actions. For the stage should alway present but one place; and the uttermost time presupposed in it should bee, both by *Aristotle's* precept and common reason, but one day; there are both many dayes and many places inartificially imagined. But if it be so in *Gorboduke*, how much more in all the rest? where you shall have *Asia* of the one side, and *Affricke* of the other, and so many other under kingdomes, that the plair, when he comes in, must ever begin with telling where hee is, or else the tale will not be conceived. Now shall you have three ladies walke to gather flowers, and then wee must beleve the stage to be a garden. By and by wee heare newes of shipwracke in the same place, then wee are to blame if we accept it not for a rocke. Upon the backe of that comes out a hideous monster with fire and smoke, and then the miserable beholders are bound to take it for a cave; while, in the mean time, two armies flie in, represented with some swordes and bucklers, and then what hard heart will not receive it for a pitched field? Now of time they are much more liberall; for ordinarie it is, that two young princes fall in love. After many traverses shee is got with childe, delivered of a faire boy; he is lost, groweth a man, falleth in love, and is readie to get another childe, and all this in two houres space; which how absurd it is in sense, even sense may imagine, and art hath taught, and all ancient examples justified, and at this day the ordinary players in *Italy* will not err in."

*Italian
tragedy.*

Italy, referred to by Sir Philip Sidney as the cradle of the reformed drama, had had her own age of liberty and confusion; her mysteries, her moralities, her historical and her romantic dramas. But the taste for the ancient and classical stage was still rooted in the country where it had flourished, and Trissino is acknowledged as the father of the regular drama. The *Sophonisba* of this learned prelate is praised by Voltaire as the first regular tragedy which Europe had seen after so many ages of barbarism. Pope has added his tribute.

When learning, after the long Gothic night,
Fair o'er the western world renewed its light,
With arts arising, *Sophonisba* rose,
The tragic muse returning wept her woes;
With her the Italian scene first learned to glow,
And the first tears for her were taught to flow.

This tragedy was represented at Rome in the year 1515. The Greek model is severely observed, and the author

has encumbered his scene with a chorus. It has some poetic beauties, and is well calculated to recommend the new or rather revived system on which it was written. *La Rosmonda* of Rucelleri was written about the same time with *Sophonisba*; and, after these pieces, tragi-comedies, histories, and romantic dramas, were discarded, and succeeded by tragedies upon a regular classical model; written in verse, having five acts, and generally a chorus.

Notwithstanding their rigorous attention to the ancient model, the modern tragic poets of Italy have not been very successful in arresting the attention of their countrymen. They are praised rather than followed; and the stern, unbending composition of Alfieri, while it has given a tone of rude and stoical dignity to his dramas, has failed in rendering them attractive. They frequently please in the closet; but the audience of modern days requires to be kept awake by something more active, more bustling, more deeply interesting, than the lessons of the schools; and a poet of high fancy has written in some measure in vain, because he has mistaken the spirit of his age. The tragic actors, also, whatever excellence they may attain to in their art, do not attract the same consideration, attention, and respect, as in France or England; and they who are the direct authors of a pleasure so nearly connected with our noblest and best feelings, occupy a rank subordinate to the performers at the opera.

It is only as a modification of the drama that we here *Opera.* propose to touch upon that entertainment of Italian growth, but known by importation in every civilized kingdom of Europe. These kingdoms have often rivalled each other in the rewards held forth to musical performers, and encouraged their merit by a degree of profusion, which has had the effect of rendering the professors petulant, capricious, and unmanageable. Their high emoluments are not granted, or their caprices submitted to, without a degree of pleasure in some degree corresponding to the expense and the sufferance; and it is in vain for the admirers of the legitimate drama to pretend that such is not obtained. Voltaire has with more justice confessed, that probably the best imitation of the ancient stage was to be found in the Italian tragic opera. The recitative resembled the musical declamation of the Athenians, and the choruses, which are frequently introduced, when properly combined with the subject, approach to those of the Greeks, as forming a contrast, by the airs which they execute, to the recitative, or modulated dialogue of the scene. Voltaire instances the tragic operas of Metastasio in particular, as approaching in beauty of diction, and truth of sentiment, near to the ancient simplicity; and finds an apology even for the detached airs, so fatal to probability, in the beauty of the poetry and the perfection of the music. And although, as a critic and man of cultivated taste, this author prefers the regular, noble, and severe beauties of the classic stage, to the effeminate and meretricious charms of the opera, still he concludes that, with all its defects, the sort of enchantment which results from the brilliant intermixture of scenery, chorus, dancing, music, dress, and decoration, subjects even the genius of criticism; and that the most sublime tragedy, and most artful comedy, will not be so frequently revisited by the same individual as an indifferent opera. We may add the experience of London to the testimony of this great critic; and, indeed, were it possible that actors could frequently be procured, possessed of the powers of action and of voice which were united in Grassini, it would be impossible to deny to the opera the praise of being an amusement as exquisite in point of taste as fascinating from show and music. But as the musical parts of the entertainment are predominant, every thing else has been too often sacrificed to the caprice of a composer, wholly igno-

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Drama. rant in every art save his own; and the mean and paltry dialogue, which is used as a vehicle for the music, is become proverbial to express nonsense and inanity.

Italian comedy. The Italian comedy, as well as their tragedy, boasts its regular descent from classical times. Like the comedy of Menander, it introduces *dramatis personæ* whose characters are never varied, and some of whom are supposed to be directly descended from the ancient *Mimi* of the Atellan Fables. Such an origin is claimed for the celebrated Harlequin, and for the no less renowned Puncinello, our English Punch, both of whom retain the character of jesters, cowards, wags, and buffoons, proper to the *Sannio* of the Romans. It is believed of these worthies that they existed before the time of Plautus, and continued to play their frolics during the middle ages, when the legitimate drama was unknown. For the former fact, sculpture, as well as tradition, is appealed to by Italian antiquaries, who have discovered the representation of these grotesque characters upon the Etruscan vases. In support of the latter averment, the grave authority of Saint Thomas Aquinas is appealed to, who, we rejoice to find, thought Harlequin and Punch no unlawful company in fitting time and place. "*Ludus*," says that eminent person, with more consideration for human infirmity than some saints of our own day, "*est necessarius ad conversationem vitæ humanæ: ad omnia autem quæ sunt utilia conversationi humanæ, deputari possunt aliqua officia licita: et ideo etiam officium histrionum quod ordinatur ad solatium hominibus exhibendum, non est secundum se illicitum, nec sunt histriones in statu peccati, dummodo moderate ludo utantur; id est, non utendo aliquibus illicitis verbis vel factis, ad ludum, et non adhibendo ludum negotiis et temporibus indebitis, unde illi qui moderate eis subveniunt, non peccant, sed juste faciunt mercedem ministerii eorum eis tribuendo. Et licet D. August. super Joan. dicit quod donare res suas histrionibus, vitium est immane, hoc intelligi debet de illis qui dant histrionibus qui in ludo utuntur illicitis, vel de illis qui superflue sua in tales consumunt, non de illis histrionibus qui moderate ludo utuntur.*"

Saint Anthony gives his sanction to Saint Thomas on this point: "*Histrionatus ars quia deservit humanæ recreationi quæ necessaria est vitæ hominis secundum D. Thomam, de se non est illicita et de illa arte vivere non est prohibitum.*" (S. Antonius in 3 part. *Suæ Summæ*, tit. iii. cap. 4.) Saint Anthony, indeed, adds the reasonable restriction, that no clergyman should play Harlequin, and that Punch should not exhibit in the church.

Under this venerable authority these *Mimi* went on and flourished. Other characters enlarged their little drama. The personages appeared in masks. "Each of these," says Mr Walker, "was originally intended as a kind of characteristic representation of some particular Italian district or town. Thus *Pantalone* was a Venetian merchant; *Dot-tore*, a Bolognese physician; *Spariento*, a Neapolitan braggadocio; *Pullicinella*, a wag of Apulia; *Giangurgolo* and *Coviello*, two clowns of Calabria; *Gelsomino*, a Roman beau; *Beltrame*, a Milanese simpleton; *Brighella*, a Ferrarese pimp; and *Arlecchino*, a blundering servant of Bergamo. Each of these personages was clad in a peculiar dress, each had his peculiar mask, and each spoke the dialect of the place he represented. Besides these, and a few other such personages, of which at least four were introduced in each play, there were the *Amorosos* or *Innamoratos*; that is, some men and women who acted serious parts, with Smeraldina, Colombina, Spilletta, and other females, who played the parts of servettas or waiting-maids. All these spoke Tuscan or Roman, and wore no masks." (*Essay on the Revival of the Drama in Italy*, p. 249.)

The pieces acted by this class of actors were called

Drama. *Commedia dell' arte*, and were congenial to the taste of the Italians, with whom gesticulation and buffoonery are natural attributes. Their drama was of the most simple kind. Each of the actors was already possessed of his dramatic character, which was as inalienable as his dress, and was master of the dialect he was to use, and had his imagination and memory stored with all the characteristic jests, or *lazzi* as they were termed, peculiar to the personage he represented. All that the author had to do was to invent the skeleton of a plot which should bring his characters into dramatic situation with respect to each other. The dialogue suited to the occasion was invented by the players, just as ours invest their parts with the proper gestures and actions. This skeleton had the name of *scenario*, and was filled up by the performers, either impromptu or in consequence of previous arrangement and premeditation. This species of comedy was extremely popular, especially among the lower class of spectators. It was often adopted as an amusement in good society, and by men of genius; and Flaminee de la Scala has left about fifty such *scenarios* adapted for representation. The fashion even found its way into England, and probably the part of Master Punch, who first appeared in the character of the *Vice* of the English morality, was trusted to the improvisatory talents of the actor. Mr d'Israeli, a curious as well as elegant investigator of ancient literature, has shown that at least one scheme of a *Commedia dell' arte* has been preserved to us. It is published in the *Variorum* edition of Shakspeare, but remains unexplained by the commentators. Such comedies, it is evident, could require no higher merit in the composer than the imagining and sketching a few comic situations; the dialogue and diction was all entrusted to the players.

The Italians, however, became early possessed of a regular comedy, which engrossed the admiration of the more cultivated classes of society. Bibbiena's comedy, entitled *La Calandra*, is composed in imitation of Terence and Plautus. It was first acted in 1490. *La Calandra* is remarkable, not only for being the first Italian comedy, but also for the perfection of scenic decoration with which it was accompanied in the representation. It was followed by the productions of Ariosto and Trissino, and other authors in the same line. But it appears, from the efforts used to support this style of drama, that it did not take kindly root in the soil, and lacked that popularity which alone can nurse it freely. Various societies were formed under the whimsical titles of *Gli Intronati*, *Gli Insensati*, and so forth, for the express purpose of bringing forward the regular drama; exertions which would certainly have been unnecessary had it received that support and encouragement which arises from general popularity.

Goldoni, in a later age, at once indulged his own fanciful genius and his natural indolence, by renouncing the classical rules, and endeavouring to throw into the old and native Italian *Mascherata* the variety and attributes of the proper comedy. He adopted Harlequin and the rest of his merry troop in the characters which they held, and endeavoured to enlist them in the more regular service of the drama, just as free corps and partizans are sometimes new-modelled into battalions of the line. This ingenious and lively writer retained all the license of the *Commedia dell' arte*, and all the immunities which it claimed from regular and classical rules; but instead of trusting to the extempore jests and grotesque wit of the persons whom he introduced, he engaged them in dialogues, as well as plots, of his own invention, which often display much humour and even pathos. It required, however, the richness of a fancy like Goldoni's to extract novelty and interest from a dramatic system in which so many of the actors held a fixed and prescriptive character, hardly

Drama. admitting of being varied. Accordingly, we do not find that the Italian stage is at present in a more flourishing condition than that of other modern nations.

French drama.

The revival of the regular drama in France was attended with important consequences, owing to the nature of her government, the general use of her language throughout Europe, and the influence which, from her situation, she must necessarily hold over other nations. It is the boast of Paris that the regular classical drama, banished from every other stage, found a safe and honourable refuge on her own. Yet France has reluctantly confessed that she also had her hour of barbarism. Her earlier drama was borrowed, like that of other countries, from Spain, who, during the whole of the sixteenth and great part of the seventeenth century, held such a formidable predominance in the European republic. While the classical stage was reviving in Italy, and the historical and romantic drama was flourishing in Spain, France was torn to pieces by civil discord. The first French tragedy composed upon a regular plan was that of *Mairet*, imitated from the *Sophonisba* of Trissino; and Riccoboni boasts with justice, that whoever shall compare the Italian tragedy of the sixteenth century with that of the French of the same period, will find the latter extravagant and irregular, and the former already possessed of gravity, dignity, and regularity. The French, like the English, date the excellence of their stage from one great author; and the illustrious name of Pierre Corneille affords to their dramatic history the mighty landmark which Shakspeare gives to our own.

Cardinal Richelieu, who had succeeded in establishing upon a broad basis the absolute power of the French monarch, was not insensible to the graces and ornaments which the throne derived from being surrounded by the muses. He was himself fond of poetry, and even a competitor for the honours of the buskin. He placed himself at the head of five dramatic writers, to whom on that account the public gave the title of *Les Cinq Auteurs*. All these are deservedly forgotten excepting Corneille, of whose successful talent the cardinal had the meanness to evince no ordinary degree of jealousy. The malevolence of that minister was carried so far that he employed the French Academy, whose complaisance must be recorded to their shame, to criticise severely the *Cid*, the first, and perhaps the finest, of Corneille's tragedies. Scudery, a favourite of the cardinal, buoyed by Richelieu's favour, was able for some time to balance Corneille in the opinion of the public; but his name is now scarcely known by any other circumstance than his imprudent and audacious rivalry. This great man was not only surrounded by the worst possible models, but unfortunately the authors of these models were also favourites of the public and of the all-powerful cardinal; yet Corneille vanquished the taste of his age, the competition of his rivals, and the envy of Richelieu.

Corneille, like his predecessors, and like Routrou in particular, borrowed liberally from the Spanish theatre; but his own taste, regulated probably upon his situation, dictated an adherence to the classical model. The French stage arose, it must be remembered, under the protection of an absolute monarch, for whose amusement the poet laboured, and in whose presence the drama was performed. It followed, as a natural consequence, that a more strict etiquette was exacted upon the scene than had hitherto been supposed applicable to a merely popular amusement. A departure from regularity in tragedy was no longer a bold flight. A violation of decorum in comedy was no longer a broad jest. When the audience was dignified by the presence of the monarch, the former became an im-

pertinence, and the latter a gross and indecent insult. The muse of comedy was therefore bound over for her good behaviour; and even her grave sister was laid under such rules and restrictions as should insure the decorum and dignity of her scene.

It was at this period that those classical fetters which are framed on the three unities were fashioned into form, and imposed on the French drama. These are acknowledged by Corneille, in his *Essay upon Dramatic Poetry*, in the following short but emphatic sentence: "*Il faut observer les unités d'action, de lieu, et de jour; personne n'en doute.*" The rule, as thus emphatically admitted by the fiery Corneille, was equally binding upon the elegant Racine, and has fettered the French stage until the present day. "*La Motte*," says Voltaire, "a man of wit and talent, but attached to paradoxes, has written in our time against the doctrine of the unities; but that literary heresy had no success."

Upon these rules, adopted by the very first writer of eminence for the French stage, and subscribed to by all succeeding dramatists, depends the principal and long-disputed difference betwixt the drama of France and those countries in which her laws of taste have been received, and the stages of Spain, England, and modern Germany, where those critical maxims have been controverted. In other words, the unities proper to the classical drama have been found inapplicable to plays of a historical or romantic plan. It is therefore necessary to examine with accuracy the essence and effect of those laws so often disputed with more obstinacy than liberality.

The arbitrary forms to which the French thus subjected their theatre are, in their general purport, founded on good and sound rules of the critical art. But, considered judiciously and literally, the interpretation put upon those unities by the French critics must necessarily lay the dramatic author under restraints equally severe and unnecessary, without affording any corresponding addition to the value of his work. The pedantry by which they are enforced reminds one of the extreme, minute, rigorous, and punctilious discipline to which some regiments have been subjected by a pedantic commanding officer, which seldom fails to lower the spirit and destroy the temper of the soldier, without being of the slightest service to him in the moment of danger or the day of battle.

The first dramatic unity is that of action, and, rightly understood, it is by far the most important. A whole, says Aristotle, is that which has a beginning, middle, and end. In short, one strong concentrated interest, upon which all subordinate incidents depend, and to which they contribute, must pervade the piece. It must open with the commencement of the play, evolve itself, and be progressive with its progress—must be perpetually in sight, and never stationary, until at length it arrives at a catastrophe, by which it is ended and extinguished. In this rule, abstractedly considered, there is nothing but what is consistent with good sense and sound criticism. The period allowed for dramatic representation is not long, and will not admit of the episodic ornaments which may be happily introduced into epic poetry. And as the restlessness or impatience of a theatrical audience is always one of its marked characteristics, it has been observed, that neither the most animated description, nor the most beautiful poetry, can ever reconcile the spectators to those inartificial scenes in which the plot or action of the piece stands still that the performers may say fine things. The introduction of an interest, separate and distinct from the main action of the play, has a still worse effect; it diminishes the effect of the whole, and divides the attention of the audience; as a pack of hounds, when in full pursuit, are impeded and puzzled by starting a fresh object of chase.

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French writers enforce the unities.

Examination of this doctrine.

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Yet even this rule must be liberally considered if we would allow dramatic authors that fair room and exercise for their genius, which gives rise to the noblest displays of genius in the art. Modern dramatists are no longer, it must be remembered, limited to the simple and surer uniformity of the ancient drama, which fixed on one single event as its object, made it the subject of the moral reflections of the chorus, managed it by the intervention of three or at most five persons, and consequently presented a picture so limited in size and subject that there was no difficulty in avoiding the intermixture of a foreign interest. The modern taste has opened the stage to a wider range of topics, which are at the same time more complicated in detail, depending on the agency of a variety of performers, and on the result of a succession of events. Such dramas have indeed an unity of action peculiar to themselves, which should predominate over and absorb every other. But although, like the oak, it should predominate over all the neighbouring underwood, its dignity is not injured by the presence and vicinity of that which it overshadows. On the contrary, a succession of events tending to the same end, if they do not divert the attention from the principal interest, cannot fail, by their variety and succession, to keep it fixed upon the business of the scene.

To take an example. In the tragedy of Macbeth a chain of varied and important events are introduced, any one link of which might be hammered out into a drama on the severe and simple model of the drama of ancient Greece. There is the murder of Duncan, that of Banquo, and the dethronement and death of the tyrant; all which are events complete of themselves, independent of each other, and yet included within one tragedy of five acts. But, nevertheless, this is never felt as a deficiency in the performance. It is to the character of Macbeth, to his ambition, guilt, remorse, and final punishment, that the mind attaches itself during the whole play; and thus the succession of various incidents, unconnected excepting by the relation they bear to the principal personage, far from distracting the attention of the audience, continues to sharpen and irritate curiosity till the curtain drops over the fallen tyrant. This is not, indeed, an unity of action according to the rule of Aristotle, or the observance of the French theatre. But, in a lighter point of view, it has all the advantage which could possibly be derived from the severest adherence to the precept of Aristotle, with this additional merit, that the interest never stagnates in declamation, or is suspended by unnecessary dialogue.

It would in fact be easy to show that the unity of action, in its strict sense, may frequently be an unnatural as well as a cumbrous restraint on the genius of the poet. In the course of nature, an insulated action seldom exists of a nature proper to transfer to the stage. If, indeed, the play is founded on some single mythological fable, or if the scene is laid in some early stage of society, when man as yet remained separated from his kind, and connected only with his petty tribe or family, the subject of a plot may be chosen where the agency of a very few persons, and these naturally connected together, may, without foreign or extraneous assistance, afford matter for a tragedy. But in the actual course of the peopled world, men are so crowded together, and their movements depend so much upon impulses foreign to themselves, that the action must often appear multiplied and complicated, and all that the author can do is to preserve the interest uniform and undivided. Its progress may be likened to that of a brook through beautiful scenery. A judicious improver of the landscape would be certainly desirous to make its course visible, but not to cut off its beautiful un-

dulations, or to compel it into a straight channel. He would follow the course of nature, and neither affect to conceal the smaller rills by which the stream was fed, nor bring them so much in view as to deprive the principal object of its consequence. We admit the difficulty inseparable from the dramatic art, and must grant that the author runs some risk of losing sight of the main interest of the piece, by dwelling upon the subordinate accessories; but we contend that the attention of the audience is still more likely to be fatigued by a bald and simple plot, to which, during the course of five acts, there must belong much speaking and little progress. And, in point of common sense and common feeling, that piece must always present unity of action which has unity of interest and feeling; which fixes the mind of the audience upon one train of thought and passion, to which every occurrence in the drama verges; and which is consummated and wound up by the final catastrophe.

The second dramatic unity is that of time, about which the critics of various nations have disagreed. If taken in its strict and proper sense, it means that the time supposed to be consumed in the action represented, should not exceed that which is occupied by the actual representation. But even Aristotle extends the duration of the action to one revolution of the sun, and Corneille extends it to thirty hours, which is to the actual period of representation as ten to one. Boileau, a supereminent authority, thus lays down the rule for the unities of time and place:

Que le lieu de la scène y soit fixé & marqué.
Un Rimeur, sans péril, delà les Pyrénées,
Sur la scène en un jour renferme des années.
Là souvent le Héros d'un spectacle grossier,
Enfant au premier acte, est Barbon au dernier,
Mais nous, que la Raison à ses règles engage,
Nous voulons qu'avec art l'action se ménage:
Qu'en un lieu, qu'en un jour, un seul fait accompli
Tienne jusqu'à la fin le Théâtre rempli.

It has been triumphantly remarked, that in thus yielding up the strict letter of the precept, in allowing the three hours employed in acting a play to be multiplied into twenty-four or thirty, the critics have retained nearly all the inconvenience of this famous rule, while they sacrificed its principle, and any advantage attached to its observance. The only benefit supposed to be attached to this unity is that of probability. We shall not at present inquire whether this is worth preserving at the cost of imposing heavy restrictions on dramatic genius. But granting the affirmative, probability is as much violated by squeezing the events of twenty-four hours into a period of only three, as if the author had exercised the still greater license of the English and Spanish theatres. There is no charm in the revolution of the sun, which circumscribes within that particular period the events of a drama. When the magic circle drawn around the author by the actual date of representation is once obliterated, the argument grounded upon probability falls; and he may extend his narrative unconfined by any rule, except what may be considered as resolving itself into the unity of action. A week, a month, a year, years may be included in the course of the drama, provided always the poet has power so to rivet the attention of the audience on the passing scene, that the lapse of time shall pass unregarded. There must be none of those marked pauses which force upon the spectators' attention the breach of this unity. Still less ought the judicious dramatist to permit his piece to embrace such a space of time as shall necessarily produce the change on the persons of the characters ridiculed by Boileau. The extravagant conduct of the plot in the *Winter's Tale* has gone far to depreciate that dra-

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ma, which, in passages of detached beauty, is inferior to none of Shakspeare's, in the opinion of the best judges. It might perhaps be improved in acting, by performing the three first acts as a play, and the fourth and fifth as an afterpiece. Yet, even as it is now acted, who is it that, notwithstanding the cold objection arising out of the breach of unity, witnesses without delight the exquisite contrast betwixt the court and the hamlet, the fascinating and simple elegance of Perdita, or the witty rogueries of Autolycus? The poet is too powerful for the critic, and we lose the exercise of our judgment in the warmth of our admiration.

The faults of Shakspeare or of his age we do not, however, recommend to the modern dramatist, whose modesty will certainly place him in his own estimation far beneath that powerful magician whose art could fascinate us even by means of deformity itself. But if for his own sake the author ought to avoid such gross violations of dramatic rule, the public, for theirs, ought not to tie him down to such severe limitations as must cramp, at least, if they do not destroy, his power of affording them pleasure. If the whole five acts are to be compressed within the space of twenty-four hours, the events must, in the general case, be either so much crowded upon each other as to destroy the very probability which it is the purpose of this law to preserve; or many of them being supposed to have happened before the commencement of the piece, must be detailed in narrative, which never fails to have a bad effect on the stage.

The same objections apply to the rigid enforcement of the third unity, that of place; and indeed the French authors have used respecting it the license of relaxing, in practice, the severity of their theory. They have frequently infringed the rule which they affirm to be inviolable; and their flexible creed permits the place to be changed, provided the audience are not transported out of the city where the scene is laid. This mitigation of doctrine, like that granted in the unity of time, is a virtual resignation of the principle contended for. Let us examine, however, upon what that principle is founded.

The rule which prohibits the shifting the scene during the period of performance, was borrowed by the French from the ancients, without considering the peculiar circumstances in which it arose. First, we have seen already, that during the ancient drama, there was no division into acts, and that the action was only suspended during the songs of the chorus, who themselves represented a certain class of personages connected with the scene. The stage, therefore, was always filled; and a supposed change of place would have implied the violent improbability that the whole chorus were transported, while in the sight of the spectators, and employed in the discharge of their parts, to the new scene of action. Secondly, there is evidence that in the *Eumenides* of Æschylus, and the *Ajax* of Sophocles, the scene is actually changed, in defiance of the presence of the chorus; and a much greater violation of probability is incurred than could have taken place in a modern theatre, where, before every change of scene, the stage is emptied of the performers. Thirdly, the ancients were less hardly pressed by this rule than the modern writers. From the extent of their theatres and the size of their stages, the place of action was considerably larger, and might be held to include a wider extent, than ours. The climate of Greece admitted of many things being transacted with propriety in the open air; and, finally, they had a contrivance for displaying the interior of a house or temple to the audience, which, if not an actual change of scene, was adapted to the same purpose.

If this long litigated question, therefore, is to be dissolved.

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posed of by precedent, we have shown that the rule of the ancients was neither absolute, nor did the circumstances of their stage correspond with those of ours; to which it may be added, that the simple and inartificial structure of their plots seldom required a change of scene. But surely it is of less consequence to examine the practice of the ancients, than to consider how far it is founded upon truth, good taste, and general effect. Granting, therefore, that the supposed illusion, which transports the spectator to the actual scene of action, really exists, let us inquire whether, in sacrificing the privilege of an occasional change of scene, we do not run the risk of shocking the spectator, and disturbing his delightful dreams, by other absurdities and improbabilities, attendant necessarily on a scrupulous adherence to this restriction.

If the action is always to pass in the scene, some place of general resort must be adopted, a hall, anti-room, or the like. It can seldom be so fortunately selected but that much must be necessarily discussed there, which, in order to preserve any appearance of probability, should be transacted elsewhere; that many persons must be introduced whose presence must appear unnatural; and that much must be done there which the very circumstances of the piece render totally absurd. Dennis has applied these observations with great force, and at the same time with great bitterness, in his critique upon *Cato*, which Johnson has quoted at length in his *Life of Addison*. The scene, it must be remembered, is laid, during the whole drama, with scrupulous attention to the classical rule, in the great hall of Cato's palace at Utica. Here the conspirators lay their plots, the lovers carry on their intrigues; and yet Sempronius, with great inconsistency, disguises himself as Juba to obtain entrance into this vestibule, which was common to all. Here Cato retires to moralize, and chides his son for interrupting him; and although he retires to stab himself, it is to this place that he is brought back to die. All this affords a striking proof how genius and taste can be fettered and embarrassed by a too pedantic observance of rules. Let no one suppose that the inconveniences arising from the rigid observance of the unity of place, occur in the tragedy of *Cato* alone; they might in that case be attributed to the inexperience or want of skill in the author. The tragedies of Corneille and Racine afford examples enough that the authors found themselves compelled to violate the rules of probability and common sense, in order to adhere to those of Aristotle. In the tragedy of *Cinna*, for example, the scene is laid in the emperor's cabinet; and in that very cabinet, compelled, doubtless, by the laws of unity, Amelia shouts forth aloud her resolution to assassinate the emperor. It is there too that Maximus and Cinna confide to each other all the secrets of their conspiracy; and it is there where, to render the impropriety more glaring, Cinna suddenly reflects upon the rashness of his own conduct:

Amis, dans ce palais on peut nous écouter ;
Et nous parlons peut-être avec trop d'imprudence,
Dans un lieu si mal propre à notre confidence.

It would be an invidious, but no difficult task, to show that several of the *chefs d'œuvres* of the French drama are liable to similar objections; and that the awkward dilemmas in which the unity of place involves them, is far more likely to destroy the illusion of the performance, than the mere change of scene would have done. But we refer the reader to the *Dramaturgie* of Lessing upon this curious topic.

The main question yet remains behind, namely, whether such an illusion is actually produced in the minds of the audience by the best-acted play, as induces them to

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suppose themselves witnessing a reality;—an illusion, in short, so complete, as to suffer from the occasional extension of time or change of place in the course of the piece? We do not hesitate to say that no such impression was ever produced on a sane understanding; and that the Parisian critic, in whose presence the unities are never violated, no more mistakes Talma for Nero, than a London citizen identifies Kemble with Coriolanus, or Kean with Richard III.¹ The ancients, from the distance of the stage, and their mode of dressing and disguising their characters, might certainly approach a step nearer to reality; and producing on their stage the very images of the deities they worshipped, speaking the language which they accounted proper to them, it is highly probable that, to minds capable of high excitation, there might be a shade of this illusion in their representations. The solemn distance of the stage, the continuous and uninterrupted action, kept the attention of the Greeks at once more closely riveted, and more abstracted from surrounding circumstances. But in the modern theatre, the rapid succession of intervals for reflection, the well-known features of the actors, the language which they speak differing frequently from that which belongs to the age and country where the scene is laid, interrupt at every turn every approximation to the fantastic vision of reality into which those writers who insist upon the strict observance of the unities suppose the audience to be lulled. To use the nervous words of Johnson, "It is false that any representation is mistaken for reality; that any dramatic fable in its materiality was ever credible, or for a single moment was ever credited." There is a conventional treaty between the author and the audience, that upon certain suppositions being granted by the latter, his powers of imagination shall be exerted for the amusement of the spectators. The postulates which are demanded, even upon the French theatre, and under the strictest model, are of no ordinary magnitude. Although the stage is lighted with lamps, the spectator must say with the subjugated Catherine,

I grant it is the sun that shines so bright.

The painted canvass must pass for a landscape; the well-known faces of the performers for those of ancient Greeks, or Romans, or Saracens; and the present time for many ages distant. He that submits to such a convention ought not scrupulously to limit his own enjoyment; that which is supposed Rome in one act, may in the next be fancied Paris; and as for time, it is, to use the words of Dr Johnson, "of all modes of existence, most obsequious to imagination; a lapse of years is as easily conceived as a passage of hours. In contemplation we easily contract the time of real actions, and therefore willingly permit it to be contracted when we only see their imitation."

If dramatic representation does not produce the impression of reality, in what, it may be asked, consists its power? We reply, that its effects are produced by the powerful emotions which it excites in the minds of the spectators. The professors of every fine art operate their impressions in the same manner, though they address themselves to different organs. The painter exhibits his scene to the eye, the orator pours his thunder upon the ear, the poet awakens the imagination of his reader by written description; but each has the same motive, the hope, namely, of exciting in the reader, hearer, or spectator, a tone of feeling similar to that which existed in his own bosom, ere it was bodied forth by his pencil, tongue, or pen. It is the artist's object, in short, to tune the reader's imagination to the same pitch with his own; and to com-

municate, as well as colours and words can do, the same sublime sensations which had dictated his own compositions. The tragedian attempts to attain this object still more forcibly, because his art combines those of the poet, orator, and artist, by storming as it were the imagination at once through the eye and the ear. Undoubtedly a drama with such advantages, and with those of dresses and costume, approaches more nearly to actual reality, and therefore has a better chance of attaining its object, especially when addressing the sluggish and inert fancies of the multitude; although it may remain a doubtful question whether, with all these means and appliances, minds of a high poetic temperature may not receive a more lively impression from the solitary perusal than from the representation of one of Shakspeare's plays. But, to the most ignorant spectator, however unaccustomed to the trick of the scene, the excitement which his fancy receives falls materially short of actual mental delusion. Even the sapient Partridge himself never thought of being startled at the apparition of the king of Denmark, which he knew to be only a man in a strange dress; it was the terror so admirably expressed by Garrick, which communicated itself to his feelings, and made him reverse the case of the fiends, and tremble without believing. In truth, the effects produced upon this imaginary character, as described by an excellent judge of human nature, exhibit, probably, the highest point of illusion to which theatrical exhibition can conduct a rational being. In an agony of terror which made his knees knock against each other, he never forgets that he is only witnessing a play. The presence of Mrs Millar and his master assures him against the reality of the apparition; yet he is no more able to subdue his terrors by this comfortable reflection, than we have been to check our tears, although well aware that the Belvidera with whose sorrows we sympathized was no other than our own inimitable Mrs Siddons. With all our passions and all our sympathies, we are still conscious of the ideal character of that which excites them; and it is probably this very consciousness of the unreality of scene that refines our sorrows into a melancholy yet delicious emotion, and extracts from it that bitterness necessarily connected with a display of similar misery in actual life.

If, therefore, no illusion subsists of a character to be affected by a change of scene, or by the prolongation of the time beyond the rules of Aristotle, the very foundation of these unities is undermined; but, at the same time, every judicious author will use liberty with prudence.

If we are inclined to ascend to the origin of these celebrated rules, we ought not to be satisfied with the *ipse dixit* of a Grecian critic, who wrote so many centuries ago, and whose works have reference to a state of dramatic composition which has now no existence. Upon the revival of letters, indeed, the authority of Aristotle was considered as omnipotent; but even Boileau remonstrated against his authority, when weighed with that of reason and common sense.

Un pedant envieux de sa vaine science,
Tout herissé de Grec, tout bouffi d'arrogance,
Et qui de mille auteurs retenus mot pour mot,
Dans la teste entassés, n'a souvent fait qu'un sot,
Croit qu'un livre fait tout, et que sans Aristote
La raison ne voit goutte, et le bon sens radote.

The opinions of Aristotle must be judged of according to the opportunities and authorities which lay open before him; and from the high critical judgment he has displayed, we can scarce err in supposing he would have drawn

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¹ See note to page 147.

Drama. different results in different circumstances. Dr Drake, whose industry and taste have concentrated so much curious information respecting Shakspeare and his age, has quoted upon this topic a striking passage from Mr Morgan's *Essay on the Character of Falstaff*.

Speaking, says Dr Drake, of the magic influence which our poet almost invariably exerts over his auditors, Mr Morgan remarks, that "on such an occasion, a fellow like *Rymer*,¹ waking from his trance, shall lift up his constable's staff, and charge this great magician, this daring *practiser of arts inhibited*, in the name of Aristotle to surrender; whilst Aristotle himself, disowning his wretched officer, would fall prostrate at his feet and acknowledge his supremacy.—O supreme of dramatic excellence! might he say, not to me be imputed the insolence of fools. The bards of *Greece* were confined within the narrow circle of the chorus, and hence they found themselves constrained to practise, for the most part, the precision, and copy the details, of nature. I followed them, and knew not that a larger circle might be drawn, and the drama extended to the whole reach of human genius. Convinced, I see that a more compendious *nature* may be obtained; a nature of *effects* only, to which neither the relation of places, or continuity of time, are always essential. Nature, condescending to the faculties and apprehensions of man, has drawn through human life a regular chain of visible causes and effects. But poetry delights in surprise, conceals her steps, seizes at once upon the heart, and obtains the sublime of things without betraying the rounds of her ascent. True poetry is *magic*, not *nature*; an effect from causes hidden or unknown. To the magician I prescribed no laws; his law and his power are one; his power is his law. If his end is obtained, who shall question his course? Means, whether apparent or hidden, are justified in poesy by success; but then most perfect and most admirable when most concealed.

"Yes, continues Mr Morgan, whatever may be the neglect of some, or the censure of others, there are those who firmly believe that this wild, this uncultivated *barbarian*, as he has been called, has not yet obtained one half of his fame; and who trust that some new Stagyrite will arise, who, instead of pecking at the surface of things, will enter into the inward soul of his compositions, and expel, by the force of congenial feelings, those foreign impurities which have stained and disgraced his page. And as to those *spots* which still remain, they may perhaps become invisible to those who shall seek them through the medium of his beauties, instead of looking for those beauties, as is too frequently done, through the smoke of some real or imputed obscurity. When the hand of time shall have brushed off his present editors and commentators, and when the very name of Voltaire, and even the memory of the language in which he has written, shall be no more, the Appalachian Mountains, the banks of the Ohio, and the plains of Sciola, shall resound with the accents of this *barbarian*. In his native tongue he shall roll the genuine passions of nature; nor shall the griefs of *Lear* be alleviated, or the charms and wit of *Rosalind* be abated, by time."²

In adopting the views of those authors who have pleaded for the liberty of the poet, it is not our intention to deny that great advantages may be obtained by the observance of the unities; not considering them as in themselves essential to the play, but only as points upon which the credibility and intelligibility of the action in some sort depends. We acknowledge, for example, that the author would be deficient in dramatic art, who should divide the

Drama. interest of his piece into two or more separate plots, instead of combining it in one progressive action. We confess, moreover, that the author, who more violently extends the time, or more frequently changes the place of representation, than can be justified by the necessity of the story, and vindicated by his exertion of dramatic force, acts unwisely, in so far as he is likely to embarrass a great part of the audience, who, from imperfect hearing or slowness of comprehension, may find it difficult to apprehend the plot of his play. The latitude which we are disposed to grant is regulated by the circumstances of the case, the interest of the plot, and, above all, the talents of the author. He that despises the praise of regularity which is attainable by study, cannot reckon on the indulgence of the audience, unless on the condition of indemnifying them by force of genius. If a definitive rule were to be adopted, we should say that it would certainly be judicious to place any change of place or extension of time at the beginning of a new act; as the falling of the curtain and cessation of the action has prepared the audience to set off, as it were, upon a new score. But we consider the whole of these points of propriety as secondary to the real purposes of the drama, and not as limitary of that gifted genius who can, in the whirlwind of his scene, bear the imagination of his audience along with him over the boundaries of place,

While panting time toils after them in vain.

It is not upon the observance of the unities alone that French no—the French found their pretensions to a classical theatre. tions of They boast also to have discarded that intermixture of *tragi-comedy*. tragic and comic scenes, which was anciently universal upon the Spanish and English stages.

If it had been only understood by this reformation, that the French condemned and renounced that species of *tragi-comedy* which comprehended two distinct plots, the one of a serious, the other of a humorous character, and these two totally unconnected, we give them full credit for their restriction. Dryden, in the *Spanish Friar*, and other pieces; and Southern, both in *Oronoko* and *Isabella*, as well as many other authors of their age, have in this particular transgressed unpardonably the unity of action. For, in the cases we have quoted, the combination of the two plots is so slight, that the serious and comic scenes separated, might each furnish forth a separate drama; so that the audience appear to be listening, not to one play only, but to two dramatic actions independent of each other, although contained in the same piece. So far, therefore, we heartily agree in the rule which excludes such an unhappy interchange of inconsistent scenes, moving upon opposite principles and interests.

When, however, the French critics carry this rule farther, and proscribe the appearance of comic or inferior characters, however intimately connected with the tragic plot, we would observe, in the first place, that they run the risk of diminishing the reality of the scene; and secondly, that they exclude a class of circumstances essential to its beauty.

On the first point it must be observed, that the rule which imposes upon valets and subordinate personages the necessity of talking as harmonious verse and as elegant poetry as their masters, entirely ruins the probability of the action. Where all is elegant, nothing can be sublime; where all is ornamented, nothing can be impressive; where all is tuned to the same smooth *falsetto* of sentiment, nothing can be natural or real. By such an assimilation of manners and language, we stamp fiction on the very front

¹ Rymer was a calumniator of Shakspeare.

² *Shakspeare and his Times*, by Nathan Drake, M.D. p. 553, 554, vol. ii.

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of our dramatic representation. The touches of nature which Shakspeare has exhibited in his lower and gayer characters, like the chastened back-ground of a landscape, increase the effect of the principal group. The light and fanciful humour of Mercutio serves, for example, to enhance and illustrate the romantic and passionate character of Romeo. Even the doating fondness and silly peevishness of the nurse tends to relieve the soft and affectionate character of Juliet, and to place her before the audience in a point of view which those who have seen Miss O'Neil perform Juliet know how to appreciate. A contrast is effected which a French author dared not attempt, but of which every bosom at once acknowledges the power and the truth. Let us suppose that the gay and gallant Mercutio had as little character as the walking confident of a French hero, who echoes the hexameters of his friend in hexameters of a lower level; or let us suppose the nurse of Juliet to be a gentle Nora, as sublime in white linen as her principal in white satin; and let the reader judge whether the piece would gain in dignity any thing proportioned to what it must lose in truth and interest. The audience at once sympathizes with the friendship of Romeo and Mercutio, rendered more natural and more interesting by the very contrast of their characters; and each spectator feels as a passion, not as a matter of reflection, that desire of vengeance which impels Romeo against Tibalt; for we acknowledge as an amiable and interesting individual the friend whom he has lost by the sword of Capulet. Even the anilities of the nurse give a reality to the piece, which, whatever French critics may pretend, is much more seriously disturbed by inconsistency of manners, than by breach of their dramatic unities. "God forbid," says Mr Puff, in the *Critic*, "that, in a free country, all the fine words in the language should be engrossed by the higher characters of the piece." The French critics did not carry their ideas of equality quite so far, but they tuned the notes of their subalterns just one pitch lower than those of their principal characters, so that their language, similar in style, but lower in sentiment and diction, presents still that subordinate resemblance and correspondence to that of their superiors, which the worsted lace upon the livery of a servant bears to the embroidery upon the coat of his master.

It is not to mere expression that these remarks are confined; for if we consult the course of human life, we shall find that mirth and sorrow, and events which cause both, are more nearly allied than perhaps it is altogether pleasing to allow. Considered relatively to a spectator, an incident may often excite a mingled emotion, partaking at once of that which is moving and that which is ludicrous; and there is no reader who has not, at some period of his life, met with events at which he hesitated whether to laugh or to cry. It remains to be proved why scenes of this dubious yet interesting description should be excluded from the legitimate drama, while their force is acknowledged in that of human life. We acknowledge the difficulty of bringing them upon the scene with their full and corresponding effect. It was perhaps under this persuasion that the fool, whose wild jests were too much the result of habit and practice to be subdued even by the terrors of the storm, has been banished from the terrific scene of King Lear. But, in yielding to this difficulty, the terrible contrast has been thus destroyed, in which Shakspeare exhibited the half perceptions of the natural fool, as contrasted with the assumed insanity of Edgar, and the real madness of the old king. They who prefer to this living variety of emotion the cold uniformity of a French scene of passion, must be numbered among those who read for the pleasure of criticism, and without hope of partaking the enthusiasm of the poet.

While we differ from French criticism respecting the right to demand an accurate compliance with the unities, and decline to censure that casual intermixture of comic character which gives at once reality and variety to the drama, we are no less disposed to condemn the impertinent love scenes which these authors have, as a matter of etiquette, introduced into all their tragedies, however alien from the passion on which they are grounded. The French drama assumed its present form under the auspices of Louis XIV. who aimed at combining all the characters of a hero of romance. The same spirit which inspired the dull monotony of the endless *folios* of Scudery and Calprenede, seemed to dictate to Corneille, and even to Racine, those scenes of frigid metaphysical passion which encumber their best plays. We do not dispute the deep interest which attaches to the passion of love, so congenial to the human breast, when it forms the groundwork of the play; but it is intolerably nauseous to find a dull love tale mingled as a indispensable ingredient in every dramatic plot, however inconsistent with the rest of the piece. The *Amoureux* and *Amoureuse* of the piece come regularly forth to recite their common-places of gallantry, in language as cold as it is exaggerated, and as inconsistent with passion and feeling as with propriety and common sense. Even the horrid tale of *Œdipus* has the misplaced garnishment of a love intrigue between Theseus, brought there for no other purpose, and a certain Dirce, whom, in the midst of the pestilence, he thus gallantly compliments:

Quelque ravage affreux qu'épale ici la peste,

L'absence aux vrais amans est encore plus funeste.

The predominance of a passion which expresses itself so absurdly is all that the French have condescended to adopt from the age of chivalry, so rich in more dramatic stores; and they have borrowed it in all its pedantry, and without its tenderness and fire. Riccoboni has probably alleged the true reason for the introduction of these heavy scenes of love intrigue, which is, that at little expense of labour to the author, they fill up three quarters of the action of his play. We quote from the French version, as that immediately before us, and most generally intelligible: "*Par exemple, ôtons de NICOMEDE les dix scènes de LAODICE, de l'ŒDIPE les dix scènes de DIRCE, de POLIEUCTE les scènes d'amour de SEVERE, de la PHEDRE de Monsieur Racine les six scènes d'ARICIE, et nous verrons que non seulement l'action ne sera point interrompue, mais qu'elle en sera plus vive; en sorte que l'on verra manifestement, que ces scènes de tendresses n'ont servi qu'à ralentir l'action de la pièce, à la refroidir, et à rendre le héros moins grand. Si après ces deux meilleurs tragédies de la France, on examine tous les autres, on connoitra bien mieux cette vérité. Lorsque l'amour fait le sujet de la tragédie, ce sentiment, si intéressant par lui-même, occupe le scène avec raison; j'aime l'amour de PHEDRE, mais de PHEDRE seule.*" Under this thralldom the fetters of the French stage long laboured, notwithstanding the noble example of *Athalie*, the chef d'œuvre of Racine. By the example of Voltaire, in one or two of his best pieces, they have of late ventured occasionally to discard their uninteresting Cupid, whose appearance on the stage as a matter of course and of ceremony, produced as little effect as when his altar and god-head are depicted on the semicircle of a fan.

We have already observed, that the refined, artificial, and affected character of the French tragedy, arose from its immediate connection with the pleasures and with the presence of an absolute sovereign. From the same circumstance, however, the French stage derived several advantages. A degree of discipline, unknown in other theatres, was early introduced among the French actors; and those of a subordinate rank, who, on the English stage,

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Drama. sometimes exhibit intolerable, contemptuous, and wilful negligence, become compelled, on that of France, to pay the same attention to their parts as their superiors, and to exert what limited talents they possess in the subordinate parts to which they are adapted. The effect of this common diligence upon the scene, is a general harmony and correspondence in its parts, which never fails to strike a stranger with admiration.

The royal protection, also, early produced on the Parisian stage an improved and splendid style of scenery, decoration, and accompaniments. The scenes and machinery which they borrowed from Italy, they improved with their usual alert ingenuity. They were still further improved under the auspices of Voltaire, who had the sole merit of introducing natural and correct costume. Before his time the actors, whether Romans or Scythians, appeared in the full dress of the French court; and Augustus himself was represented in a huge full-bottomed wig, surmounted by a crown of laurel. The strict national costume introduced by Voltaire is now observed. That author has also the merit of excluding the idle crowd of courtiers and men of fashion who thronged the stage during the time of representation, and formed a sort of semicircle round the actors, leaving them thus but a few yards of an area free for performance, and disconcerting at once the performers and the audience, by the whimsical intermixture of players and spectators. The nerves of those pedants who contended most strenuously for the illusion of the scene, and who objected against its being interrupted by an occasional breach of the dramatic unities, do not appear to have suffered from the presence of this singular chorus.

Corneille. It was not decoration and splendour alone which the French stage owed to Louis XIV. Its principal obligation was for that patronage which called forth in its service the talents of Corneille and Racine, the Homer and the Virgil of the French drama. However constrained by pedantic rules; however held back from using that infinite variety of materials which national and individual character presented to them; however frequently compelled by system to adopt a pompous, solemn, and declamatory style of dialogue; these distinguished authors still remain the proudest boast of the classical age of France, and a high honour to the European republic of letters. It seems probable that Corneille, if left to the exercise of his own judgment, would have approximated more to the romantic drama. The *Cid* possesses many of the charms of that species of composition. In the character of Don Gourmaz, he has drawn a national portrait of the Spanish nobility, for which very excellence he was subjected to the censure of the academy, his national court of criticism. In a general point of view, he seems to have been ambitious of overawing his audience by a display of the proud, the severe, the ambitious, and the terrible. Tyrants and conquerors have never sat to a painter of greater skill; and the romantic tone of feeling which he adopts in his more perfect characters is allied to that of chivalry. But Corneille was deficient in tenderness, in dramatic art, and in the power of moving the passions. His fame, too, was injured by the multiplicity of his efforts to extend it. Critics of his own nation have numbered about twenty of his dramas which have little to recommend them; and no foreign reader is very likely to verify or refute the censure, since he must previously read them to an end.

Racine. Racine, who began to write when the classical fetters were clenched and riveted upon the French drama, did not make that effort of struggling with his chains which we observe in the elder dramatist; he was strong where Corneille evinced weakness, and weak in the points where his predecessor showed vigour. Racine delineated the

passion of love with truth, softness, and fidelity; and his scenes of this sort form the strongest possible contrast with those in which he, as well as Corneille, sacrificed to the dull Cupid of metaphysical romance. In refinement and harmony of versification, Racine has hitherto been unequalled; and his *Athalie* is, perhaps, likely to be generally acknowledged as the most finished production of the French drama.

Subsequent dramatists, down to the time of Voltaire, were contented with imitating the works of these two great models, until the active and ingenious spirit of that celebrated author seems tacitly to have meditated further experimental alterations than he thought it prudent to defend or to avow. His extreme vivacity and acute intellect were mingled, as is not unfrequent in such temperaments, with a certain nervous timidity, which prevented him from attempting open and bold innovation, even where he felt compliance with existing rules most inconvenient and dispiriting. He borrowed, therefore, liberally from Shakespeare, whose irregularities were the frequent object of his ridicule; and he did not hesitate tacitly to infringe the dramatic unities in his plays, while in his criticism he holds them up as altogether inviolable. While he altered the costume of the stage, and brought it nearer to that of national truth, he made one or two irresolute steps towards the introduction of national character. If we were, indeed, to believe the admirers of Corneille, little remained to be done in this department; he had already, it is said, taught his Romans to speak as Romans, and his Greeks as Greeks; but of such national discrimination foreigners are unable to perceive a trace. His heroes, one and all, talk like men of no peculiar character or distinct age and nation, but, like the other heroes of the French dramatic school, are "all honourable men," who speak in high, grave, buskined rhimes, where an artificial brilliancy of language, richness of metaphor, and grandeur of sentiment, are substituted for that concise and energetic tone of dialogue, which shows at once the national and individual character of the personage who uses it. In *Mahomet*, *Alzire*, and one or two other pieces, Voltaire has attempted some discrimination of national character; the groundwork, however, is still French; and, under every disguise, whether of the turban of the Ottoman, the feathery crown of the savage, or the silk tunic of the Chinese, the character of that singular people can be easily recognized. Voltaire probably saw the deficiency of the national drama with his usual acuteness; but, like the ancient philosophers, he contentedly joined in the idolatry which he despised.

It seems, indeed, extremely doubtful whether the French tragedy can ever be brought many steps nearer to nature. That nation is so unfortunate as to have no poetical language; so that some degree of unnatural exaltation of sentiment is almost necessary to sustain the tone of tragedy at a pitch higher than that of ordinary life. The people are passionately fond of ridicule; their authors are equally afraid of incurring it: they are aware, like their late ruler, that there is but one step betwixt the sublime and the ridiculous; and they are afraid to aim at the former, lest their attempt, falling short, should expose them to derision. They cannot reckon on the mercy or enthusiasm of their audience; and while they banish combats and deaths, and even violent action of any kind, from the stage, this seems chiefly on account of the manifest risk that a people, more alive to the ludicrous than the lofty, might laugh when they should applaud. The drunken and dizzy fury with which Richard, as personated by Kean, continues to make the motion of striking after he has lost his weapon, would be caviare to the Parisian parterre. Men must compound with their poets and actors,

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and pardon something like extravagance, on the score of enthusiasm. But if they are nationally dead to that enthusiasm, they resemble a deaf man listening to eloquence, who is more likely to be moved to laughter by the gestures of the orator, than to catch fire at his passionate declamation.

Above all, the French people are wedded to their own opinions. Each Parisian is, or supposes himself, master of the rules of the critical art; and whatever limitations it imposes on the author, the spectators receive some indemnification from the pleasure of sitting in judgment upon him. To require from a dancer to exhibit his agility without touching any of the lines of a diagram chalked on the floor, would deprive the performance of much ease, strength, and grace; but still the spectator would feel a certain interest in watching the dexterity with which the artist avoided treading on the interdicted limits, and a certain pride in detecting occasional infringements. In the same manner, the French critic obtains a triumph from watching the transgressions of the dramatic poet against the laws of Aristotle; equal, perhaps, to the more legitimate pleasure he might have derived from the unfettered exercise of his talents. Upon the whole, the French tragedy, though its regulations seem to us founded in pedantry, and its sentiments to belong to a state of false and artificial refinement, contains, nevertheless, passages of such perfect poetry and exquisite moral beauty, that to hear them declaimed with the art of Talma, cannot but afford a very high pitch of intellectual gratification.

French comedy.

The French comedy assumed a regular shape about the same period with the tragedy; and Molière was in his department what Corneille and Racine were in theirs; an original author, approached in excellence by none of those that succeeded him. The form which he assumed for a model was that of the comedy of Menander, and he has copied pretty closely some pieces from the Latin stage. Molière was endowed by nature with a rich fund of comic humour, which is nowhere more apparent than in those light pieces which are written upon the plan of the Italian masked comedy. In these he has introduced the jealous old pantaloon, the knavish and mischievous servant, and some of its other characters. In his regular comedy he soared to a higher pitch. Before his time the art had sought its resources in the multiplicity and bustle of intrigue, escape, and disguise,—of, at best, in a comic dialogue, approaching to mere buffoonery. Molière's satire aimed at a nobler prey; he studied mankind for the purpose of attacking those follies of social life which are best exposed by ridicule. The aim of few satirists has been so legitimate, or pursued with such success. Female vanity, learned pedantry, unreasonable jealousy, the doating and disgraceful passions of old men, avarice, coquetry, slander, the quacks who disgrace medicine, and the knaves who prostitute the profession of the law, were the marks at which his shafts were directed.

Molière's more regular comedies are limited by the law of unities, and finished with great diligence. It is true, the author found it sometimes necessary tacitly to elude the unity of place, which he durst not openly violate; but, in general, he sacrifices probability to system. In the *Ecole des Femmes*, Arnolph brings his wife into the street, out of the room in which his jealousy has imprisoned her, in order to lecture her upon the circumspection due to her character; which absurdity he is guilty of, that the scene may not be shifted from the open space before his door to her apartment. In general, however, it may be noticed, that the critical unities impose much less hardship upon the comic than upon the tragic poet. It is much more easy to reconcile the incidents of private life to the unities of time and place, than to compress within their

limits the extensive and prolonged transactions which comprehend the revolution of kingdoms and fate of monarchs. What influence, however, these rules do possess, must operate to cramp and embarrass the comic as well as the tragic writer; to violate and disunite those very probabilities which they affect to maintain; and to occasion a thousand real absurdities rather than grant a conventional license, which seems essential to the freedom of the drama.

The later comic authors of France seem to have abandoned the track pointed out by Molière, as if in despair of approaching his excellence. Their comedy, compared with that of other nations, and of their great predecessor, is cramped, and tame, and limited. In this department, as in tragedy, the stage experienced the inconvenience arising from the influence of the court. The varied and unbounded field of comic humour which the passions and peculiarities of the lower orders present, was prohibited, as containing subjects of exhibition too low and vulgar for a monarch and his courtiers; and thus the natural, fresh, and varied character of comedy was flung aside, while the heartless vices and polished follies of the great world were substituted in its place. Schlegel has well observed, that the object of French comedy "is no longer life, but society; that perpetual negotiation between conflicting vanities which never ends in a sincere treaty of peace; the embroidered dress, the hat under the arm, and the sword by the side, essentially belong to them; and the whole of the characterization is limited to the folly of the men and the coquetry of the women."

It is scarcely in nature that a laughter-loving people should have remained satisfied with an amusement so dull and insipid as their regular comedy. A few years preceding the revolution, and while the causes of that event were in full fermentation, the *Marriage of Figaro* appeared on the stage. It is a comedy of intrigue; and the dialogue is blended with traits of general and political satire, as well as with a tone of licentiousness, which was till then a stranger to the French stage. It was received with a degree of enthusiastic and frantic popularity which nothing but its novelty could have occasioned, for there is little real merit in the composition. Frederick of Prussia, and other admirers of the old theatrical school, were greatly scandalized at so daring an innovation on the regular French comedy. The circumstances which followed have prevented Beaumarchais' example from being imitated; and the laughs have consoled themselves with inferior departments of the drama. Accordingly, we find the blank supplied by farces, comic operas, and dramatic varieties, in which plots of a light, flimsy, and grotesque character are borne out by the comic humour of the author and comic skill of the actor. Brunet, a comedian of extraordinary powers in this cast of interludes, has at times presumed so far upon his popularity as to season his farce with political allusions. It will scarce be believed that he aimed several shafts at Napoleon when in the height of his power. The boldness as well as the wit of the actor secured him the applause of the audience; and such a hold had Brunet of their affections, that an imprisonment of a few hours was the greatest punishment which Bonaparte ventured to inflict upon him. But whatever be the attachment shown to the art in general, the French, like ourselves, rest the character of their theatre chiefly upon the ancient specimens of art; and the regular tragedy, as well as comedy, seems declining in that kingdom.

As the drama of France was formed under the patronage of the monarch, and bears the strongest proofs of its courtly origin, that of England, which was encouraged by the people at large, retains equally unequivocal marks of its popular descent. Its history must naturally draw to

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I. From the revival of the theatre until the great civil war.

II. From the Restoration to the reign of Queen Anne.

III. From the earlier part of the last century down to the present reign.

IV. The present state of the British drama.

First period of the English drama. I. The drama of England commenced, as we have already observed, upon the Spanish model. *Ferrex and Perrex* was the first composition approaching to a regular tragedy, and it was acted before Queen Elizabeth, upon the 18th day of January 1561, by the gentlemen of the Inner Temple. It partakes rather of the character of a historical than of a classical drama, although more nearly allied to the latter class than the chronicle plays which afterwards took possession of the stage. We have already recorded Sir Philip Sidney's commendation of this play, which he calls by the name of *Gorboduc*, from one of the principal characters. Acted by a learned body, and written in great part by Lord Sackville, the principal author of the *Mirror for Magistrates*, the first of English tragedies assumed in some degree the honours of the learned buskin; but although a chorus was presented according to the classical model, the play was free from the observance of the unities, and contains many irregularities severely condemned by the regular critics.

English comedy, considered as a regular composition, is said to have commenced with *Gammer Gurton's Needle*. This "right pithy, pleasant, and merry comedy," was the supposed composition of John Still, Master of Arts, and afterwards Bishop of Bath and Wells. It was acted in Christ-Church College, Cambridge, in 1575. It is a piece of low humour, the whole jest turning upon the loss and recovery of the needle with which Gammer Gurton was to repair the breeches of her man Hodge; but, in point of manners, it is a great curiosity, as the *curta suppellex* of our ancestors is scarcely anywhere so well described. The popular characters also, the Sturdy Beggar, the Clown, the Country Vicar, and the Shrew of the sixteenth century, are drawn in colours taken from the life. The unity of time, place, and action, are observed through the play with an accuracy of which France might be jealous. The time is a few hours; the place, the open square of the village before Gammer Gurton's door; the action, the loss of the needle; and this, followed by the search for and final recovery of that necessary implement, is intermixed with no other thwarting or subordinate interest, but is progressive from the commencement to the conclusion.

It is remarkable that the earliest English tragedy and comedy are both works of considerable merit; that each partakes of the distinctive character of its class; that the tragedy is without intermixture of comedy, the comedy without any intermixture of tragedy.

These models were followed by a variety of others, in which no such distinctions were observed. Numerous theatres sprung up in different parts of the metropolis, opened upon speculation by distinct troops of performers. Their number shows how much they interested public curiosity; for men never struggle for a share in a losing profession. They acted under licenses, which appear to

Drama. have been granted for the purpose of police alone, not of exclusive privilege or monopoly; since London contained, in the latter part of the sixteenth century, no fewer than fourteen distinct companies of players, with very considerable privileges and remunerations. (See Drake's *Shakspeare and his Times*, vol. ii. p. 205.)

The public, therefore, in the widest sense of the word, was at once arbiter and patron of the drama. The companies of players who traversed the country might indeed assume the name of some peer or baron, for the sake of introduction or protection; but those of the metropolis do not, at this early period of our dramatic history, appear to have rested in any considerable degree upon learned or aristocratic privilege. Their license was obtained from the crown, but their success depended upon the voice of the people; and the pieces which they brought forward were, of course, adapted to popular taste. It followed necessarily that histories and romantic dramas were the favourites of the age. A general audience in an unlearned age requires rather amusement than conformity to rules, and is more displeased with a tiresome uniformity than shocked with the breach of all the unities. The players and dramatists, before the rise of Shakspeare, followed, of consequence, the taste of the public, and dealt in the surprising, elevating, and often bombastic incidents of tragedy, as well as in the low humour and grotesque incident of the comic scene. Where these singly were found to lack attraction, they mingled them together, and dashed their tragic plot with an under-intrigue of the lowest buffoonery, without any respect to taste or congruity.

The clown was no stranger to the stage; he interfered, without ceremony, in the most heart-rending scenes, to the scandal of the more learned spectators.

Now lest such frightful shows of fortune's fall,
And bloody tyrant's rage, should chance appall
The death-struck audience, 'midst the silent rout
Comes leaping in a self-misformed lout,
And laughs and grins, and frames his mimic face,
And jostles straight into the prince's place;
Then doth the theatre echo all aloud
With gladsome noise of that applauding crowd,
A goodly hotchpotch, where vile russetings
Are matched with monarchs and with mighty kings.

An ancient stage-trick, illustrative of the mixture of tragic and comic action in Shakspeare's time, was long preserved in the theatre. Henry IV. holding council before the battle of Shrewsbury, was always represented as seated on a drum; and when he rose and came forward, the place was occupied by Falstaff, which seldom failed to produce a laugh from the galleries. The taste and judgment of the author himself was very different. During the whole scene Falstaff gives only once, and under irresistible temptation, the rein to his petulant wit, and it is instantly checked by the prince, to whom, by the way, and not to the king, his words ought to be addressed.

The English stage might be considered as equally without rule and without model when Shakspeare arose. The effect of the genius of an individual upon the taste of a nation is mighty; but that genius, in its turn, is formed according to the opinions prevalent at the period when it comes into existence. Such was the case with Shakspeare. With an education more extensive, and a taste refined by the classical models, it is probable that he also, in admiration of the ancient drama, might have mistaken the form for the essence, and subscribed to those rules which had produced such masterpieces of art. Fortunately for the full exertion of a genius as comprehensive and versatile as intense and powerful, Shakspeare had no access to any models of which the commanding merit might have controlled and limited his own exertions. He followed the

Drama. path which a nameless crowd of obscure writers had trodden before him; but he moved in it with the grace and majestic step of a being of a superior order, and vindicated for ever the British theatre from a pedantic restriction to classical rule. Nothing went before Shakspeare which in any respect was fit to fix and stamp the character of a national drama; and certainly no one will succeed him capable of establishing by mere authority a form more restricted than that which Shakspeare used.

Such is the action of existing circumstances upon genius, and the re-action of genius upon future circumstances. Shakspeare and Corneille were each the leading spirit of his age; and the difference between them is well marked by the editor of the latter. "*Corneille est inégal comme Shakspeare, et plein de génie comme lui; mais le génie de Corneille étoit à celui de Shakspeare ce qu'un seigneur est à l'égard d'un homme de peuple né avec le même esprit que lui.*" This distinction is strictly accurate, and contains a compliment to the English author which, assuredly, the critic did not intend to make. Corneille wrote as a courtier, circumscribed within the imaginary rules and ceremonies of a court, as a chicken is by a circle of chalk drawn round it. Shakspeare, composing for the amusement of the public alone, had within his province, not only the inexhaustible field of actual life, but the whole ideal world of fancy and superstition; more favourable to the display of poetical genius than even existing realities. Under the circumstances of Corneille, Shakspeare must have been restricted to the same dull, regular, and unvaried system. He must have written, not according to the dictates of his own genius, but in conformity to the mandate of some *intendant des menus plaisirs*; or of some minister of state, who, like Cardinal Richelieu, thought he could write a tragedy because he could govern a kingdom. It is not equally clear to what height Corneille might have ascended had he enjoyed the national immunities of Shakspeare. Each pitched down a land-mark in his art. The circle of Shakspeare was so extended, that it is with advantage liable to many restrictions; that of Corneille included a narrow limit, which his successors have deemed it unlawful to extend.

It is not our intention, within the narrow space to which our essay is necessarily limited, to enlarge upon the character and writings of Shakspeare. We can only notice his performances as events in the history of the theatre—of a gigantic character indeed, so far as its dignity, elevation, and importance are considered; but, in respect of the mere practice of the drama, rather fixing and sanctioning, than altering or reforming those rules and forms which he found already established. This we know for certain, that those historical plays or chronicles, in which Shakspeare's muse has thrown a never-fading light upon the history of his country, did, almost every one of them, exist before him in the rude shape of dry dialogue and pitiful buffoonery, stitched into scenes by the elder playwrights of the stage. His romantic dramas exhibit the same contempt of regularity which was manifested by Marlow and other writers; for where there was abuse or extreme license upon the stage, the example of Shakspeare may be often quoted as its sanction, never as tending to reform it. In these particulars the practice of our immortal bard was contrasted with that of Ben Jonson, a severe and somewhat pedantic scholar; a man whose mind was coarse, though capable both of strength and elevation, and whose strong perception of comic humour was tinged with vulgarity.

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Jonson's tragic strength consists in a sublime, and sometimes harsh, expression of moral sentiment; but displays little of tumultuous and ardent passion, still less of tenderness or delicacy; although there are passages in which

he seems adequate to expressing them. He laboured in the mine of the classics, but overloaded himself with the ore, which he could not or would not refine. His *Cataline* and *Sejanus* are laboured translations from Cicero, Sallust, and Tacitus, which his own age did not endure, and which no succeeding generation will probably be much tempted to revive. With the stern superiority of learning over ignorance, he asserted himself a better judge of his own productions than the public which condemned him, and haughtily claimed the laurel which the public suffrage often withheld; but the world has as yet shown no disposition to reverse the opinion of their predecessors.

In comedy Jonson made some efforts partaking of the character of the older comedy of the Grecians. In his *Tale of a Tub* he follows the path of Aristophanes, and lets his wit run into low buffoonery, that he might bring upon the stage Inigo Jones, his personal enemy. In *Cynthia's Revels* and the *Staple of News*, we find him introducing the dull personification of abstract passions and qualities, and turning legitimate comedy into an allegorical mask. What interest can the reader have in such characters as the three Penny boys, and their transactions with the Lady Pecunia? Some of Jonson's more legitimate comedies may be also taxed here with filthiness of language, of which disgusting attribute his works exhibit more instances than any English writer of eminence excepting Swift. Let us, however, be just to a master-spirit of his age. The comic force of Jonson was strong, marked, and peculiar; and he excelled even Shakspeare himself in drawing that class of truly English characters, remarkable for peculiarity of *humour*; that is, for some mode of thought, speech, and behaviour, superinduced upon the natural disposition by profession, education, or fantastical affectation of singularity. In blazoning these forth with their natural attributes and appropriate language, Ben Jonson has never been excelled, and his works everywhere exhibit a consistent and manly moral, resulting naturally from the events of the scene.

It must also be remembered, that although it was Jonson's fate to be eclipsed by the superior genius, energy, and taste of Shakspeare, yet those advantages which enabled him to maintain an honourable though an unsuccessful struggle, were of high advantage to the drama. Jonson was the first who showed by example the infinite superiority of a well-conceived plot, all the parts of which bore upon each other, and forwarded an interesting conclusion over a tissue of detached scenes, following without necessary connection or increase of interest. The plot of the *Fox* is admirably conceived; and that of the *Alchemist*, though faulty in the conclusion, is nearly equal to it. In the two comedies of *Every Man in his Humour* and *Every Man out of his Humour*, the plot deserves much less praise, and is deficient at once in interest and unity of action; but in that of the *Silent Woman* nothing can exceed the art with which the circumstance upon which the conclusion turns is, until the very last scene, concealed from the knowledge of the reader, while he is tempted to suppose it constantly within his reach. In a word, Jonson is distinguished by his strength and stature, even in those days when there were giants in the land, and affords a model of a close, animated, and characteristic style of comedy, abounding in moral satire, and distinguished at once by force and art, which was afterwards more cultivated by English dramatists, than the lighter, more wild, and more fanciful department in which Shakspeare moved, beyond the reach of emulation.

The general opinion of critics has assigned genius as the characteristic of Shakspeare, and art as the appropriate excellence of Jonson; not surely that Jonson was deficient in genius, but that art was the principal character-

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Drama. istic of his laborious scenes. We learn from his own confession, and from the panegyrics of his friends, as well as the taunts of his enemies, that he was a slow composer. The natural result of laborious care is jealousy of fame; for that which we do with labour, we value highly when achieved. Shakspeare, on the other hand, appears to have composed rapidly and carelessly, and sometimes even without considering, while writing the earlier acts, how the catastrophe was to be huddled up, in that which was to conclude the piece. We may fairly conclude him to have been indifferent about fame, who would take so little pains to win it. Much perhaps might have been achieved by the union of these opposed qualities, and by blending the art of Jonson with the fiery invention and fluent expression of his great contemporary. But such an union of opposite excellencies in the same author was hardly to be expected; nor perhaps would the result have proved altogether so favourable as might at first view be conceived. We should have had more perfect specimens of the art, but they must have been much fewer in number; and posterity would certainly have been deprived of that wild luxuriance of dramatic excellencies and poetic beauties, which, like wild flowers upon a common field, lie scattered profusely among the unacted plays of Shakspeare.

Massinger. Although incalculably superior to his contemporaries, Shakspeare had successful imitators, and the art of Jonson was not unrivalled. Massinger appears to have studied the works of both with the intention of uniting their excellencies. He knew the strength of plot; and although his plays are altogether irregular, yet he well understood the advantage of a strong and defined interest; and in unravelling the intricacy of his intrigues, he often displays the management of a master. Art, therefore, not perhaps in its technical, but in its most valuable sense, was Massinger's as well as Jonson's; and, in point of composition, many passages of his plays are not unworthy of Shakspeare. Were we to distinguish Massinger's peculiar excellence, we should name that first of dramatic attributes, a full conception of character, a strength in bringing out, and consistency in adhering to it. He does not, indeed, always introduce his personages to the audience in their own proper character; it dawns forth gradually in the progress of the piece, as in the hypocritical Luke, or in the heroic Marullo. But, upon looking back, we are always surprised and delighted to trace from the very beginning, intimations of what the personage is to prove as the play advances. There is often a harshness of outline, however, in the character of this dramatist, which prevents their approaching to the natural and easy portraits bequeathed us by Shakspeare.

Beaumont and Fletcher. Beaumont and Fletcher, men of remarkable talent, seemed rather than Jonson's, and thus to have altogether neglected that art which Jonson taught, and which Massinger in some sort practised. They may, indeed, be rather said to have taken for their model the boundless license of the Spanish stage, from which many of their pieces are expressly and avowedly derived. The acts of their plays are so detached from each other, in substance and consistency, that the plot scarce can be said to hang together at all, or to have, in any sense of the word, a beginning, progress, and conclusion. It seems as if the play began because the curtain rose, and ended because it fell, the author, in the mean time, exerting his genius for the amusement of the spectators, pretty much in the same manner as in the *Scenario* of the Italians, by the actors filling up, with their extempore wit, the scenes chalked out for them. To compensate for this excess of irregularity, the plays of Beaumont and Fletcher have still a high poetical value.

If character be sometimes violated, probability discarded, and the interest of the plot neglected, the reader is, on the other hand, often gratified by the most beautiful description, the most tender and passionate dialogue, a display of brilliant wit and gaiety, or a feast of comic humour. These attributes had so much effect on the public, that, during the end of the seventeenth and the beginning of the eighteenth centuries, many of Beaumont and Fletcher's plays had possession of the stage, while those of Shakspeare were laid upon the shelf.

Shirley, Ford, Webster, Decker, and others, added performances to the early treasures of the English drama, which abound with valuable passages. There never, probably, rushed into the lists of literary competition together a band more distinguished for talent. If the early drama be inartificial and unequal, no nation at least can show so many detached scenes, and even acts, of distinguished poetical merit. One powerful cause seems to have produced an effect so marked and distinguished, to wit, the universal favour of a theatrical public, which daily and nightly thronged the numerous theatres then open in the city of London.

In considering this circumstance, it must above all be remembered that these numerous audiences crowded, not to feast their eyes upon show and scenery, but to see and hear the literary production of the evening. The scenes which the stage exhibited were probably of the most paltry description. Some rude helps to the imagination of the audience might be used by introducing the gate of a castle or town; the monument of the Capulets, by sinking a trap-door, or by thrusting in a bed. The good-natured audience readily received these hints, with that conventional allowance which Sir Philip Sidney had ridiculed, and which Shakspeare himself has alluded to when he appeals from the poverty of theatrical representation to the excited imagination of his audience.

.....Can this cockpit hold
The vasty fields of France? Or may we cram
Within this wooden O, the very casques
That did affright the air at Agincourt?
O, pardon! since a crooked figure may
Attest, in little space, a million;
And let us, ciphers to this great account,
On your imaginary forces work;
Suppose, within the girdle of these walls,
Are now confined two mighty monarchies,
Whose high upreared and abutting fronts
The perilous narrow ocean parts asunder;
Printing their proud hoops i' the receiving earth.
For 'tis your thoughts that now must deck our kings,
Carry them here and there; jumping o'er times;
Turning the accomplishment of many years
Into an hour-glass.....

Such were the allowances demanded by Shakspeare and his contemporaries from the public of their day, in consideration of the imperfect means and appliances of their theatrical machinery. Yet the deficiency of scenery and show, which, when existing in its utmost splendour, divides the interest of the piece in the mind of the ignorant, and rarely affords much pleasure to a spectator of taste, may have been rather an advantage to the infant drama. The spectators having nothing to withdraw their attention from the immediate business of the piece, gave it their full and uninterrupted attention. And here it may not be premature to inquire into the characteristic difference between the audiences of the present day, and those earlier theatrical ages, when the drama boasted not only the names of Shakspeare, of Massinger, of Jonson, of Beaumont and Fletcher, of Shirley, of Ford, and others of subordinate degree; the meanest of whom shows occasionally more fire than warms whole reams of modern plays. This will probably be found

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to rest on the varied and contrasted feelings with which the audience of ancient and that of modern days attend the progress of the scene.

Nothing, indeed, is more certain than that the general cast of theatrical composition must receive its principal bent and colouring from the taste of the audience :

The drama's laws, the drama's patrons give;
For those who live to please, must please to live.

But though this be an undeniable, and in some respects a melancholy truth, it is not less certain that genius, labouring in behalf of the public, possesses the power of re-action, and of influencing in its turn that taste to which it is in some respects obliged to conform ; while, on the other hand, the playwright, who aims only to catch the passing plaudit and the profit of a season, by addressing himself exclusively to the ruling predilections of the audience, degrades the public taste still farther by the gross food which he ministers to it, unless it shall be supposed that he may contribute involuntarily to rouse it from its degeneracy, by cramming it even to satiety and loathing. This action, therefore, and re-action of the taste of the age on dramatic writing, and *vice versa*, must be both kept in view when treating of the difference betwixt the days of Shakspeare and our own.

Perhaps it is the leading distinction betwixt the ancient and modern audiences, that the former came to listen and to admire ; to fling the reins of their imaginations into the hands of the authors and actors, and to be pleased, like the reader to whom Sterne longed to do homage, " they knew not why, and cared not wherefore." The novelty of dramatic entertainments (for there elapsed only about twenty years betwixt the date of *Gammer Gurton's Needle*, accounted the earliest English play, and the rise of Shakspeare) must have had its natural effect upon the audience. The sun of Shakspeare arose almost without a single gleam of intervening dawn ; and it was no wonder that the audience, introduced to this enchanting and seductive art at once, under such an effulgence of excellence, should have been more disposed to wonder than to criticise ; to admire, or rather to adore, than to measure the height or ascertain the course of the luminary which diffused such glory around him. The great number of theatres in London, and the profusion of varied talent which was dedicated to this service, attest the eagerness of the public to enjoy the entertainments of the scene. The ruder amusements of the age lost their attractions ; and the royal bear-ward of Queen Elizabeth lodged a formal complaint at the feet of her majesty, that the play-houses had seduced the audience from his periodical bear-baitings. This fact is worth a thousand conjectures ; and we can hardly doubt that the converts, transported by their improving taste from the bear-garden to the theatre, must, generally speaking, have felt their rude minds subdued and led captive by the superior intelligence, which not only placed on the stage at pleasure all ranks, all ages, all tempers, all passions of mere humanity, but extended its powers beyond the bounds of time and space, and seemed to render visible to mortal eyes the secrets of the invisible world. We may, perhaps, form the best guess of the feelings of Shakspeare's contemporary audience, by recollecting the emotions of any rural friend, of rough but sound sense and ardent feelings, whom we have had the good fortune to conduct to a theatre for the first time in his life. It may be well imagined that such a spectator thinks little of the three dramatic unities, of which Aristotle says so little, and his commentators and followers talk so much ; and that the poet and the performers have that enviable influence over his imagination, which transports him from place to place at pleasure, crowds years into the course of hours,

and interests him in the business of each scene, however disconnected from the others. His eyes are riveted to the stage, his ears drink in the accents of the speakers, and he experiences in his mature age, what we have all felt in childhood, a sort of doubt whether the beings and business of the scene be real or fictitious. In this state of delightful fascination, Shakspeare and the gigantic dramatic champions of his age found the British public at large ; and how they availed themselves of the advantages which so favourable a temper afforded them, their works will show so long as the language of Britain continues to be read. It is true that the enthusiastic glow of the public admiration, like the rays of a tropical sun darted upon a rich soil, called up in profusion weeds as well as flowers ; and that, spoiled in some degree by the indulgent acceptance which attended their efforts, even our most admired writers of Elizabeth's age not unfrequently exceeded the bounds of critical nicety, and even of common taste and decorum. But these eccentricities were atoned for by a thousand beauties, to which, fettered by the laws of the classic drama, the authors would hardly have aspired, or, aspiring, would hardly have attained. All of us know and feel how much the exercise of our powers, especially those which rest on keen feeling and self-confidence, is dependent upon a favourable reception from those for whom they are put in action. Every one has observed how a cold brow can damp the brilliancy of wit and fetter the flow of eloquence ; and how both are induced to send forth sallies corresponding in strength and fire, upon being received by the kindred enthusiasm of those whom they have addressed. And thus, if we owe to the indiscriminate admiration with which the drama was at first received, the irregularities of the authors by whom it was practised, we also stand indebted to it, in all probability, for many of its beauties, which became of rare occurrence, when, by a natural, and indeed a necessary change, satiated admiration began to give way to other feelings.

When a child is tired of playing with a new toy, its next delight is to examine how it is constructed ; and, in like manner, so soon as the first burst of public admiration is over with respect to any new mode of composition, the next impulse prompts us to analyse and to criticise what was at first the subject of vague and indiscriminate wonder. In the first instance, the toy is generally broken to pieces ; in the other, while the imagination of the authors is subjected to the rigid laws of criticism, the public generally lose in genius what they may gain in point of taste. The author who must calculate upon severe criticism turns his thoughts more to avoid faults than to attain excellence, as he who is afraid to stumble must avoid rapid motion. The same process takes place in all the fine arts ; their first productions are distinguished by boldness and irregularity ; those which succeed, by a better and more correct taste, but also by inferior and less original genius.

The original school founded by Shakspeare and Ben Jonson, continued by Massinger, Beaumont and Fletcher, Shirley, Ford, and others, whose compositions are distinguished by irregularity as well as genius, was closed by the breaking out of the great civil war in 1642. The stage had been the constant object of reprobation and abhorrence on the part of the puritans, and its professors had no favour to expect at their hands if victorious. We read, therefore, with interest, but without surprise, that almost all the actors took up arms in behalf of their old master King Charles, in whose service most of them perished. Robinson, a principal actor at the Blackfriars, was killed by Harrison in cold blood, and under the application of a text of scripture,—“ Cursed is he that doeth the work of the Lord negligently.” A few survivors endeavoured occasionally to practise their art in secrecy and obscurity,

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Drama. but were so frequently discovered, plundered and stripped by the soldiers, that "*Enter the red-coat, Exit hat and cloak,*" was too frequent a stage direction. Sir William Davenant endeavoured to evade the severe zealots of the time, by representing a sort of opera, said to have been the first drama in which moveable scenery was introduced upon the stage. Even the cavaliers of the more grave sort disapproved of the revival of these festive entertainments during the unstable and melancholy period of the interregnum. "I went," says the excellent Evelyn, in his *Diary*, 5th May 1658, "to see a new opera after the Italian way; in recitation, music, and scenes, much inferior to the Italian composure and magnificence; but it was prodigious that in such a time of public consternation, such a variety should be kept up or permitted, and being engaged with company, could not decently resist the going to see it, though my heart smote me for it." Davenant's theatrical enterprise, abhorred by the fanaticism of the one party, and ill adapted to the dejected circumstances of the other, was not probably very successful.

Second period of the English drama. II. With royalty the stage revived in England. But the theatres in the capital were limited to two, a restriction which has never since been extended. This was probably by the advice of Clarendon, who endeavoured, though vainly, to stem at all points the flood of idle gaiety and dissipation which broke in after the Restoration. The example of France might reconcile Charles to this exertion of royal authority. With this restoration of the drama, as well as of the crown, commences the second part of English dramatic history.

Introduction of the heroic plays. Charles II. had been accustomed to enjoy the foreign stage during his exile, and had taste enough to relish its beauties. It is probable, however, that his judgment was formed upon the French model, for few of the historical or romantic dramas were revived at the restoration. So early as 26th of November 1662, the *Diary* of Evelyn contains this entry: "I saw Hamlet, Prince of Denmark, played; but now the old plays began to disgust this refined age, since his majesty has been so long abroad." Dryden, Howard, and others, who obtained possession of the stage, introduced what was for some time called Heroic Plays, written in couplets, and turning upon the passions of love and honour. In the dialogue, these pieces resembled that of the French stage, where the actors declaim alternately in the best language and in the finest thoughts which the poet can supply, but without much trace of natural passion or propriety of character. But though French in dialogue and sentiment, the heroic plays were English in noise and bustle, and the lack of truth and nature was supplied by trumpets and tempests, victories and processions. An entertainment of a character so forced and unnatural was obviously of foreign growth, and flowed from the court. Dryden himself has assured us "that the favour which heroic plays had acquired upon the stage was entirely owing to the countenance which they had received at court; and that the most eminent persons for wit and humour in the royal circle had so far honoured them, that they judged no way so fit as verse to entertain a noble audience, or express a noble passion." In these pieces the unities were not observed; but in place of the classical restrictions, there were introduced certain romantic whimsical limitations of the dramatic art, which, had they been adopted, must soon have destroyed all its powers of pleasing. The characters were avowedly formed upon the model of the French romance, where honour was a sort of insane gasconading extravagance, and who seem to have made a vow never to speak or think of any thing but love, and that in language sometimes ingeniously metaphysical, sometimes puerile to silliness, sometimes mad even to raving, but always absurd, unnatural, and extra-

vagant. In point of system it was stated, that a heroic play should be an imitation of a heroic poem. The laws of such compositions did not, it was said, dispense with those of the elder drama, but exalted them, and obliged the poet to draw all things as far above the ordinary proportion of the stage, as the stage itself is beyond the common words and actions of human life. The effects which a heroic play, constructed upon such an overstrained model, produced, is well described by Mrs Evelyn, wife of the author of that name already quoted, in a letter to Mr Bohun, written in 1671. "Since my last to you I have seen the *Siege of Grenada*, a play so full of ideas, that the most refined romance I ever read is not to compare with it. Love is made so pure, and valour so nice, that one would imagine it designed for an Utopia rather than our stage. I do not quarrel with the poet, but admire one born in the decline of morality should be able to feign such exact virtue; and as poetic fiction has been instructive in former ages, I wish this the same event in ours. As to the strict law of comedy, I dare not pretend to judge. Some think the division of the story not so well as if it could all have been comprehended in the day of action. Truth of history, exactness of time, possibilities of adventures, are niceties which the ancient critics might require; but those who have outdone them in fine notions may be allowed the liberty to express them their own way, and the present world is so enlightened that the old dramatique must bear no sway. This account perhaps is not enough to do *Mr Driden* right, yet is as much as you can expect from the leisure of one who has the care of a nursery." (See Evelyn's *Works*.) This ingenious lady felt what, overawed by the fashion of the moment, she has intimated rather than expressed; namely, that the heroic drama, notwithstanding the fine poetry of which it may be made the vehicle, was overstrained, fantastical, and unnatural.

In comedy, also, there was evinced, subsequent to the Restoration, a kindred desire of shining in dialogue rather than attempting the humorous delineation of character of which Shakspeare, Jonson, and the earlier schools, had set the example. The comic author no longer wrote to move the hearty laugh of a popular assembly, but to please a fashionable circle, "the men of wit and pleasure about town," with whom wit and raillery is always more prevailing than humour. As in tragedy, therefore, the authors exhausted trope and figure, and reduced to logic the language of heroic passion; so in comedy, a succession of smart jests, which neither serve to advance the action of the piece, nor display the character of the speaker, was bandied to and fro upon the stage.

Satire is the appropriate corrective of extravagance in Heroic composition; and the *Rehearsal* of the Duke of Buckingham, though it can scarcely be termed a work of uncommon power, had yet the effect of holding up to public ridicule the marked and obvious absurdities of the revived drama in both its branches. After the appearance of this satire, a taste too extravagant for long endurance was banished from the theatre; both tragedy and comedy retraced their steps, and approached more nearly to the field of human action, passion, and suffering; and, down to the revolution, a more natural style of drama occupied the stage. It was supported by men of the highest genius, who, but for one great leading error, might perhaps have succeeded in giving to the art its truest and most energetic character. The talents of Otway, in his scenes of passionate affection, rival at least, and sometimes excel, those of Shakspeare. More tears have been shed, probably, for the sorrows of Belvidera and Monimia than for those of Juliet and Desdemona. The introduction of actresses upon the stage was scarcely known before the Restoration, and it furnished the poets of the latter period

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with appropriate representatives for their female characters. This more happy degree of personification, as it greatly increased the perfection of the scene, must have animated in proportion the genius of the author. A marked improvement, therefore, may be traced in love scenes, and, indeed, in all those wherein female characters are introduced; that which was to be spoken by a fitting representative was of course written with more care, as it was acted with greater effect. This was an advantage, and a great one, possessed by the theatre succeeding the Restoration. Great dramatic force and vigour marked the dramatic compositions of this age. It was not, indeed, equal to that of Shakspeare, either in point of the talent called forth, or the quantity of original poetry given to the public; but Otway, and even Lee, notwithstanding his bombastic rant, possessed considerable knowledge of dramatic art and stage-effect. Several plays of this period have kept possession of the stage; less perhaps on account of intrinsic merits, than because some of the broad errors of the earlier age had been removed, and a little more art had been introduced in the combination of the scenes, and disentanglement of the plot. The voice of criticism was frequently heard; the dramatic rules of the ancients were known and quoted; and though not recognized in their full extent, had nevertheless some influence in regulating the action of the drama.

Gross immorality of the drama.

In one heinous article, however, the poets of this age sinned at once against virtue, good taste, and decorum; and endangered, by the most profligate and shameless indecency, the cause of morality, which has been often considered as nearly allied with that of the legitimate drama. In the first period of the British stage, the actors were men of decent character, and often acquired considerable independence. The women's parts were acted by boys. Hence, although there were too many instances of low and licentious dialogue, there were few of that abominable species which addresses itself, not to the fancy, but to the passions, and is seductive, instead of being ludicrous. Had Charles II. borrowed from the French monarchs the severe etiquette of their court, when he introduced into England something resembling the style of their plays, he would have asserted what was due to his own dignity, and the cause of sound morals and good manners, by prohibiting this vulgar and degrading license, which in itself was insulting to the presence of a king. It was, however, this prince's lot, in the regulation of his amusements, as well as in his state government, to neglect self-respectability. In his exile he had been "merry, scandalous, and poor;" had been habituated to share familiarly coarse jests and loose pleasures with his dissolute companions; and unfortunately he saw no reason for disusing the license to which he had accustomed himself, when it was equally destructive to his own character and to decorum. What had been merely coarse was, under his influence, rendered vicious and systematic impurity. Scenes, both passionate and humorous, were written in such a style as if the authors had studied whether the grave seduction of the heroic, or the broad infamy of the comic scenes, should contain the grossest insult to public decency. The female performers were of a character proper to utter whatever ribaldry the poet chose to put into their mouths; and as they practised what they taught, the king himself, and the leading courtiers, formed connections which gave the actress a right to be saucy in their presence, and to reckon upon their countenance when practising in public the effrontery which marked their intercourse in private life. How much this shocked the real friends of Charles, is shown by its effects upon Evelyn, whose invaluable *Diary* we have already quoted: "This night was acted my Lord Broghill's tragedy called Mustapha, before their majesties

at court, at which I was present; though very seldom now going to the public theatres, for many reasons, as they are now abused to an atheistical liberty. Foul and indecent women now, and never till now, are permitted to appear and act, who, inflaming several young noblemen and gallants, became their misses, and some their wives: witness the Earl of Oxford, Sir R. Howard, P. Rupert, the Earl of Dorset, and another greater person than any of them, who fell into their snares, to the reproach of their noble families, and ruin of both body and soul." He elsewhere repeatedly expresses his grief and disgust at the pollution and degeneracy of the stage. (Evelyn's *Works*, vol. i. p. 392.) In a letter to Lord Cornbury (son of the great Clarendon), he thus expresses himself: "In the town of London there are more wretched and indecent plays permitted than in all the world besides;" and adds shortly after, "If my Lord Chancellor would but be instrumental in reforming this one exorbitancy, it would gain both the king and his lordship multitudes of blessings. You know, my lord, that I (who have written plays, and am a scurvy poet too sometimes) am far from puritanism; but I would have no reproach left our adversaries, in a theme which may so conveniently be reformed. Plays are now with us become a licentious exercise, and a vice, and need severe censors, that should look as well to their morality as to their lines and numbers." And, at the hazard of multiplying quotations, we cannot suppress the following:—1st March 1671. "I walked with him (the king) through St James's Park to the garden, where I both heard and saw a very familiar discourse betwixt—(i. e. the king) and Mrs Nelly (Gwyn), as they called an impudent comedian, she looking out of her terrace at the top of the wall, and — [the king] standing in the green walk under it. I was heartily sorry at this scene."

The foul stain, so justly censured by a judge so competent and so moderate as Evelyn, was like that of the leprosy in the Levitical law, which sunk into and pervaded the very walls of the mansion; it became the leading characteristic of the English theatre, of its authors, and of its players. It was, however, especially in comedy that this vice was most manifest; and, to say truth, were not the eyes of antiquaries, like the ears of confessors, free from being sullied by the impurities committed to them, the comedies of this period, as well as the comic scenes introduced to relieve the tragedies, are fitter for a brothel than for the library of a man of letters.

It is a pity that we are under the necessity of drawing the character of the drama at this age from a feature so coarse and disgusting. Unquestionably, as the art in other respects made progress, it might, but for this circumstance, have reached an uncommon pitch of perfection. The comedies of Congreve contain probably more wit than was ever before embodied upon the stage; each word was a jest, and yet so characteristic, that the repartee of the servant is distinguished from that of the master; the jest of the coxcomb from that of the humorist or fine gentleman of the piece. Had not Sheridan lived in our own time, we could not have conceived the possibility of rivaling the comedies of Congreve. This distinguished author understood the laws of composition, and combined his intrigue with an art unusual on the British stage. Nor was he without his rivals, even where his eminence was most acknowledged. Vanburgh and Farquhar, inferior to Congreve in real wit, and falling into the next period, were perhaps his equals in the composition of acting plays. Like other powerful stimulants, the use of wit has its bounds, which Congreve is supposed sometimes to have exceeded. His dialogue keeps the attention too much upon the stretch, and, however delightful in the closet, fatigues the mind during the action. When you are per-

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The light, lively, but somewhat more meagre dialogue of the latter dramatists of the period, and of that which succeeded, was found sufficient to interest, yet was not so powerful as to fatigue the audience. Vanburgh and Farquhar seemed to have written more from the portraits of ordinary life; Congreve from the force of his own conception. The former, therefore, drew the characters of men and women as they found them; selected, united, and heightened for the purpose of effect, but without being enriched with any brilliancy foreign to their nature. But all the personages of Congreve have a glimpse of his own fire, and of his own acuteness. He could not entirely lay aside his quick powers of perception and reply, even when he painted a clown or a coxcomb; and all that can be objected, saving in a moral sense, to this great author, is his having been too prodigal of his wit; a faculty used by most of his successors with rigid economy.

That personification of fantasy or whim called characters of humour, which Ben Jonson introduced, was revived during this period. Shadwell, now an obscure name, endeavoured to found himself a reputation, by affecting to maintain the old school, and espousing the cause of Ben Jonson against Dryden and other innovators. But although there was considerable force of humour in some of his forgotten plays, it was Wycherly upon whom fell the burthen of upholding the standard of the Jonsonian school. The *Plain Dealer* is indeed imitated from Molière; but the principal character has more the force of a real portrait, and is better contrasted with the perverse, bustling, masculine, petty-fogging, and litigious character of Widow Blackacker, than Alceste is with any of the characters in the *Misanthrope*. The other plays of this author are marked by the same strong, masculine, and forcible painting, which approaches more to the satire of Jonson, than to the ease of Vanburgh, the gaiety of Farquhar, or the wit of Congreve. Joining, however, the various merits of these authors, as belonging to this period, they form a galaxy of comic talent scarce to be matched in any other age or country; and which is only obscured by those foul and impure mists which their pens, like the raven wings of Sycorax, had brushed from fern and bog.

Morals repeatedly insulted long demanded an avenger; and he arose in the person of Jeremy Collier. It is no disgrace to the memory of this virtuous and well-meaning man, that, to use the lawyer's phrase, he pleaded his cause too high; summoned unnecessarily to his aid the artillery with which the Christian fathers had fulminated against the heathen drama; and pushing his arguments to extremity, directed it as well against the use as against the abuse of the stage. Those who attempted to reply to him availed themselves, indeed, of the weak parts of his arguments; but, upon the main points of impeachment, the poets stood self-convicted. Dryden made a manly and liberal submission, though not without some reflections upon the rudeness of his antagonist's attacks. "I shall say the less of Mr Collier, because in many things he has taxed me justly; and I have pleaded guilty to all thoughts and expressions of mine which can be truly accused of obscenity, profaneness, or immorality, and retract them. If he be my enemy, let him triumph; if he be my friend, as I have given him no occasion to be otherwise, he will be glad of my repentance. It becomes me not to draw

my pen in the defence of a bad cause, when I have so often drawn it for a good one. Yet it were not difficult to prove, that in many places he has perverted my meaning by his glosses, and interpreted my words into blasphemy and bawdry, of which they were not guilty; besides, that he is too much given to horse-play in his raillery, and comes from battle like a dictator from the plough. I will not say, 'the zeal of God's house has eaten him up;' but I am sure it has devoured some part of his good manners and civility." Congreve, less prudent, made an angry and petulant defence, yet tacitly admitted the charge brought against him, by retrenching in the future editions of his plays, passages of grossness and profaneness, which the restless antiquary still detects in the early copies. And, on the whole, Collier's satire was attended with such salutary effects, that men started at the mass of impudence and filth which had been gradually accumulated in the theatre during the last reigns; and if the Augean stable was not sufficiently cleansed, the stream of public opinion was fairly directed against its conglomerated impurities. Since that period, indecency, that easy substitute for wit and pleasantry, has been gradually banished from the drama, where the conversation is now (according to Sheridan) at least always moral, if not entertaining.

During the second period of the British drama, great improvement was made in point of art. The principles of dramatic composition were more completely understood, and the poets themselves had written so much upon the subject, that, as Dryden somewhere complains, they had taught their audience the art of criticising their performances. They did not, however, so far surrender the liberties and immunities of their predecessors, as to receive laws from the French critics. The rules of the unities were no further adopted by Otway, Congreve, and the writers of the time, than their immediate purpose admitted. It was allowed on all hands that unnecessary and gross irregularities were to be avoided, but no precise rule was adopted. Poets argued upon the subject according to caprice, and acted according to convenience. Gross and palpable extensions of time, and frequent changes of place, were avoided; and, unless in tragi-comedies, authors studied to combine the intrigue of their play into one distinct and progressive action. The genius by which this art was supported was neither so general nor so profuse as that which decorated the preceding period. It was enough, however, to support the honour of the drama; and if the second period has produced fewer masterpieces of talent, it has exhibited more plays capable of being acted.

III. In the third period of dramatic history, the critics began to obtain an authority for which they had long struggled, and which might have proved fatal to the liberties of the stage. It is the great danger of criticism, when laying down abstract rules without reference to any example, that these regulations can only apply to the form, and never to the essence, of the drama. They may assume that the plot must be formed on a certain model, but they cannot teach the spirit which is to animate its progress. They cannot show how a passion should be painted, but they can tell to a moment when the curtain should be dropped. The misfortune is, that, while treating of these subordinate considerations, critics exalt them to an undue importance in their own minds and that of their scholars. What they carve out for their pupils is a mere dissection of a lifeless form; the genius which animated it escapes, as the principle of life glided from the scalpel of those anatomists who sought to detect it in the earlier days of that art. Rymer had, as early as 1688, discovered that our poetry of the last age was as rude as its architecture. "One cause thereof," he continues,

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Third period of the English drama.

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"might be, that Aristotle's *Treatise of Poetry* has been so little studied amongst us; it was, perhaps, commented upon by all the great men in *Italy*, before we well knew (on this side of the Alps) that there was such a book in being." Accordingly, Rymer endeavours to establish what he calls the Rule of Reason over Fancy, in the contrivance and economy of a play. "Those who object to this subjugation," he observes, "are mere fanatics in poetry, and will never be saved by their good works." The species of reason, however, to which Rymer appeals, resembles, in its occult nature, that which lies hidden in the depths of municipal law, and which is better known to the common class of mankind under the name of Authority. Because Aristotle assigns Pity and Terror as the objects of tragedy, Rymer resumes the proposition, that no other source of passion can be legitimate. To this he adds some arbitrary rules, of which it would be difficult to discover the rationale. It was the opinion, we are told, of the ancients, "that comedy (whose province was humour and ridiculous matter only) was to represent worse than the truth, history to describe the truth, but tragedy was to invent things better than the truth. Like good painters, they must design their images like the life, but yet better and more beautiful than the life. The malefactor of tragedy must be a better sort of malefactor than those that live in the present age: For an obdurate, impudent, and impenitent malefactor, can neither move compassion nor terror, nor be of any imaginable use in tragedy." It would be difficult to account for these definitions upon any logical principle, and impossible for an admirer of the drama to assent to a rule which would exclude from the stage Iago and Richard III. It is equally difficult to account for the rationale of the following dogmas: "If I mistake not, in poetry no woman is to kill a man, except her quality gives her the advantage above him; nor is a servant to kill his master; nor a private man, much less a subject, to kill a king, nor on the contrary. Poetical decency will not suffer death to be dealt to each other by such persons, whom the laws of duel allow not to enter the lists together." (Rymer's *View of the Tragedies of the Last Age*.) Though for these and similar critical conceits it would be difficult to find any just principle, nevertheless, Rymer, Dennis, and other critics, who, mixing observations founded on sound judgment and taste, with others which rested merely upon dauntless assertion, or upon the opinions of Aristotle, began thereby to extend their authority, and produce a more than salutary influence upon the drama. It is true, that both of the aristarchs whom we have named were so ill advised as themselves to attempt to write plays, and thereby most effectually proved that it was possible for a drama to be extremely regular, and at the same time intolerably dull. Gradually, however, their precepts, in despite of their example, gained influence over the stage. They laid down rules in which the audience were taught to regard the trade of a connoisseur as easy and soon learned; and the same quantity of technical jargon which, in the present day, constitutes a judge of painting, was, in the beginning of the eighteenth century, sufficient to elevate a templar into a dramatic critic. The court of criticism, though self-constituted, was sufficiently formidable, since they possessed the power of executing their own decrees. Many authors made their submission; amongst others, Congreve humbled himself in the *Mourning Bride*; and Addison, with anxious and constitutional timidity, sacrificed to the unities in his celebrated tragedy of *Cato*. Being in form and essence rather a French than an English play, it is one of the few English tragedies which foreigners have admired. It was translated into Italian, and admired as a perfect model by Riccoboni, although his taste condemns the silly love intrigue. Its

Unfavourable influence of dramatic criticism.

success was contagious. Southerne and Rowe may be considered as belonging to the same school; although the former admired Shakspeare, and the latter formed himself, in some degree, on the model of Otway. Translations of French tragedies became every day more frequent; and their diction and style of dialogue was imitated upon the British stage. The language of tragedy no longer expressed human passion, or intimated what the persons of the drama actually felt, but described and debated alternately what they ought to feel; and sounding sentences, and long similes, exhibiting an active fancy and a cold imagination, supplied at once the place of force and of pathos.

The line between comedy and tragedy was now strictly drawn. The latter was no longer permitted to show that strain of heroic humour which exhibits itself in the character of Falconbridge, Hotspur, and Henry V., as well as Mercutio. All was to be cold and solemn, and in the same key of dull, grave state. Neither was comedy relieved by the touches of pathetic tenderness, and even sublimity, which are to be found in the romantic plays of the earlier period. To compensate the audience for the want of this beautiful variety of passion and feeling, Southerne, as Otway had done before him, usually introduces a few scenes of an under-plot, containing the most wretched and indecent farce, which was so slightly and awkwardly dovetailed into the original tragedy, that they have since been cancelled as impertinent intrusions, without being so much as missed. Young, Thomson, and others who followed the same wordy and declamatory system of composition, contributed rather to sink than to exalt the character of the stage. The two first were both men of excellent genius, as their other writings have sufficiently testified; but, as dramatists, they wrought upon a false model, and their productions are of little value.

It is a remarkable instance of the decay of dramatic art at this period, that several of the principal authors of the time felt themselves at liberty to write imitations of old plays belonging to the original school, by way of adapting them to the taste of their own age. The *Fair Penitent* of Rowe is well known as a poor imitation of Massinger's *Fatal Dowry*. It does not greatly excel the original in the management and conduct of the piece; and, in every thing else, falls as far beneath it as the baldest translation can sink below the most spirited original.

It would appear that the players of this period had adopted a mode of acting correspondent to the poetical taste of the time. Declamation seems to have been more in fashion in the school of Booth and Betterton than that vivacity of action that exhibits at once with word, eye, and gesture, the immediate passion which it is the actor's part to express. "I cannot help," says Cibber, "in regard to truth, remembering the rude and riotous havoc we made of all the late dramatic honours of the theatre: all became at once the spoil of ignorance and self-conceit. Shakspeare was defaced, and tortured in every signal character; *Hamlet* and *Othello* lost, in one hour, all their good sense, their dignity, and fame; *Brutus* and *Cassius* became noisy blusterers, with bold unmeaning eyes, mistaken sentiments, and turgid elocution." (Cibber's *Memoirs*.)

A singular attempt to deviate from the prevailing taste in tragedy was made by Lillo, with the highly laudable purpose of enlarging the sphere of dramatic utility. He conceived that plays founded upon incidents of private life might carry more immediate conviction to the mind of the hearers, and be the means of stifling more vices in the bud, than those founded on the more remote and grander events of history. Accordingly, he formed his plots from domestic crimes, and his characters never rose

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Lillo endeavours to enlarge the sphere of tragedy.

Drama. above the ranks of middle life. Lillo had many requisites for a tragedian; he understood, either from innate taste or critical study, the advantage to be derived from a consistent fable; and, in the tragedy of the *Fatal Curiosity*, he has left the model of a plot, in which, without the help of any exterior circumstances, a train of events operating upon the characters of the dramatic persons produce a conclusion at once the most dramatic and the most horrible that the imagination can conceive. Neither does it appear that, as a poet, Lillo was at all inferior to others of his age. He possessed a beautiful fancy; and much of his dialogue is as forcibly expressed as it is well conceived. On some occasions, however, he sinks below his subject; and on others, he appears to be dragged down to the nether sphere in which it is laid, and to become cold and creeping, as if depressed with the consciousness that he was writing upon a mean subject. *George Barnwell* never rises above an idle and profligate apprentice; Milwood's attractions are not beyond those of a very vulgar woman of the town; *Thoroughgood*, as his name expresses, is very worthy and very tiresome; and there is, positively, nothing to redeem the piece, excepting the interest arising from a tale of horror, and the supposed usefulness of the moral. The *Fatal Curiosity* is a play of a very different cast, and such as might have shaken the Grecian stage even during the reign of terror. But the powers of the poet prove unequal to the concluding horrors of his scene. Old Wilmot's character, as the needy man who had known better days, exhibits a mind naturally good, but prepared for acting evil, even by the evil which he has himself suffered, and opens in a manner which excites the highest interest and expectation. But Lillo was unable to sustain the character to the close. After discovering himself to be the murderer of his son, the old man falls into the common cant of the theatre; he talks about computing sands, increasing the noise of thunder, adding water to the sea, and fire to *Ætna*, by way of describing the excess of his horror and remorse; and becomes as dully desperate, or as desperately dull, as any other despairing hero in the last scene of a fifth act.

Genteel comedy.

During this third period of the drama, comedy underwent several changes. The department called genteel comedy, where the persons as well as the foibles ridiculed were derived chiefly from high life, assumed a separate and distinct existence from that which ransacked human nature at large for its subject. Like the tragedy of the period, this particular species of comedy was borrowed from the French. It was pleasing to the higher classes, because it lay within their own immediate circle, and turned upon the topics of gallantry, persiflage, affectation, and raillery. It was agreeable to the general audience, who imagined they were thereby admitted into the presence of their betters, and enjoyed their amusement at their expense. The *Careless Husband* of Cibber is, perhaps, the best English play on this model. The general fault to which they are all liable is their tendency to lower the tone of moral feeling; and to familiarize men, in the middling, with the cold, heartless, and selfish system of profligate gallantry practised among the higher ranks. We are inclined to believe that, in a moral point of view, genteel comedy, as it has been usually written, is more prejudicial to public morals, than plays the tendency of which seems at first more grossly vicious. It is not so probable that the *Beggar's Opera* has sent any one from the two-shilling gallery to the highway, as that a youth entering upon the world, and hesitating between good and evil, may be determined to the worse course by the gay and seductive example of *Lovemore* or *Sir Charles Easy*. At any rate, the tenderness with which vices are shaded off into foibles familiarizes them to the mind of the hearer,

and gives a false colouring to those crimes which should be placed before the mind in their native deformity. But the heaviness of this class of plays, and the difficulty of finding adequate representatives for those characters which are really well drawn, are powerful antidotes to the evil which we complain of. That which is dully written, and awkwardly performed, will not find many imitators.

The genteel comedy being a plant of foreign growth, never obtained exclusive possession of the English stage, any more than court dresses have been adopted in our private societies. The comedy of intrigue, borrowed, perhaps, originally from the Spaniards, continued to be written and acted with success. Many of Cibber's pieces, of *Centlivre's*, and others, still retain their place on the stage. This is a species of comedy easily written, and seen with pleasure, though consisting chiefly of bustle and complicated incident; and requiring much co-operation of the dress-maker, scene-painter, and carpenter. After all the bustle, however, of surprise, and disguise, and squabble; after every trick is exhausted, and every stratagem played off, the writer too often finds himself in a labyrinth from which a natural mode of extrication seems altogether impossible. Hence the intrigue is huddled up at random; and the persons of the drama seem, as if by common consent, to abandon their dramatic character before throwing off their stage-dresses. The miser becomes generous; the peevish cynic good humoured; the libertine virtuous; the coquette is reformed; the debauchee is reclaimed; all vices natural and habitual are abandoned by those most habitually addicted to them: a marvellous reformation, which is brought about entirely from the consideration that the play must now be concluded. It was when pressed by this difficulty that Fielding is said to have damned all fifth acts.

The eighteenth century, besides genteel comedy, and comedy of intrigue, gave rise to a new species of dramatic amusement. The Italian opera had been introduced into this country at a great expense, and to the prejudice, as it was supposed, of the legitimate drama. Gay, in aiming at nothing beyond a parody of this fashionable entertainment, and making it the vehicle of some political satire against Sir Robert Walpole's administration, unwittingly laid the foundation of the English opera. The popularity of his piece was unequalled; partly owing to its peculiar humour, partly to its novelty, partly to the success of the popular airs, which every body heard with delight, and partly to political motives. The moral tendency of the *Beggar's Opera* has been much questioned; although, in all probability, the number of highwaymen is not more increased by the example of Macheath, than that of murderers is diminished by the catastrophe of *George Barnwell*. Many years ago, however, an unhappy person, rather from a perverted and most misplaced ambition, than from the usual motives of want and desperation, chose, though in easy circumstances, and most respectably connected, to place himself at the head of a band of thieves and housebreakers, whose depredations he directed and shared. On the night on which they committed the crime for which he suffered, and when they were equipped for the expedition, he sung to his accomplices the chorus of the *Beggar's Opera*, "Let us take the road." But his confederates, professional thieves, and who pursued, from habit and education, the desperate practices which Mr B—— adopted from an adventurous spirit of profligate quixotry, knew nothing at all of Gay or the *Beggar's Opera*; and, in their several confessions and testimonies, only remembered something of a *flash-song*, about "turning lead to gold." This curious circumstance, while it tends to show that the drama may affect the weak part of a mind, predisposed to evil by a diseased imagina-

Drama.

Comedy of intrigue.

English opera.

Drama. tion, proves the general truth of what Johnson asserts in the *Life of Gay*, that "highwaymen and housebreakers seldom mingle in any elegant diversions; nor is it possible for any one to imagine that he may rob with safety because he sees Macheath reprieved on the stage."

This play is now chiefly remarkable as having given rise to the English opera. In this pleasing entertainment, it is understood that the plot may be light and the characters superficial, provided that the music be good and adapted to the situation, the scenes lively and possessed of comic force. Notwithstanding the subordinate nature of this species of composition, it approaches, perhaps, more closely to the ancient Grecian drama than any thing which retains possession of our stage. The subjects, indeed, are as totally different as the sublime from the light and the trivial. But, in the mixture of poetry and music, and in the frequent introduction of singing characters unconnected with the business of the piece, and therefore somewhat allied to the chorus, the English opera has some general points of resemblance with the Grecian tragedy. This species of dramatic writing was successfully practised by Bickerstaff, and has been honoured by the labours of Sheridan.

Fourth period of the English drama.

IV. With the fourth era of our dramatic history commenced a return to a better taste, introduced by the celebrated David Garrick. The imitations of French tragedy, and the tiresome uniformity of genteel comedy, were ill adapted to the display of his inimitable talent. And thus, if the last generation reaped many hours of high enjoyment from the performances of this great actor, the present is indebted to him for having led back the public taste to the dramas of Shakspeare.

Revival of the plays of Shakspeare.

The plays of this great author had been altogether forgotten, or so much marred and disguised by interpolations and alterations, that he seems to have arisen on the British stage with the dignity of an antique statue disencumbered from the rubbish in which it had been enveloped since the decay of the art. But, although Garrick showed the world how the characters of Shakspeare might be acted, and so far paved the way for a future regeneration of the stage, no kindred spirit arose to imitate his tone of composition. His supremacy was universally acknowledged; but it seemed as if he was regarded as an object of adoration, not of imitation; and that authors were as much interdicted the treading his tragic path, as the entering his magic circle. It was not sufficiently remembered that the faults of Shakspeare, or rather of his age, are those into which no modern dramatist is likely to fall; and that he learned his beauties in the school of nature, which is ever open to all who profess the fine arts. Shakspeare may, indeed, be inimitable, but there are inferior degrees of excellence, which talent and study cannot fail to attain; and the statuary were much to blame who, in despair of modelling a Venus like that of Phidias, should set himself to imitate a Chinese doll. Yet such was the conduct of the dramatists of Britain long after the supremacy of Shakspeare had been acknowledged. He reigned a Grecian prince over Persian slaves; and they who adored him did not dare attempt to use his language. The tragic muse appeared to linger behind the taste of the age, and still used the constrained and mincing measure which she had been taught in the French school. Hughes, Cumberland, and other men of talent, appeared in her service; but their model remained as imperfect as ever; and it was not till our own time that any bold efforts were made to restore to tragedy that truth and passion, without which declamation is only rant and impertinence. Horace Walpole, however, showed what might be done by adopting a more manly and vigorous style of composition; and Home displayed the success of a more natural current of passion.

Tragedy of this period.

The former, chusing a theme not only totally unfit for representation, but from which the mind shrinks in private study, treated it as a man of genius, free from the trammels of habit and of pedantry. His characters in the *Mysterious Mother* do not belong to general classes, but have bold, true, and individual features; and the language approaches that of the first age of the English drama. The *Douglas* of Home is not recommended by this species of merit. In diction and character it does not rise above other productions of the period. But the interest turns upon a passion which finds a response in every bosom; for those who are too old for love, and too young for ambition, are all alike awake to the warmth and purity of maternal and filial affection. The scene of the recognition of Douglas's birth possesses a power over the affections, which, when supported by adequate representation, is scarcely equalled in the circle of our drama. It is remarkable that the ingenious author was so partial to this theatrical situation, as to introduce it in several of his other tragedies.

The comedy of the fourth period is chiefly remarkable for exhibiting *The Rivals* and the *School for Scandal*. Critics prefer the latter, whilst the general audience reap, perhaps, more pleasure from the former; the pleasantry being of a more general cast, the incident more complicated and varied, and the whole plot more interesting.

In both these plays, the gentlemanlike ease of Farquhar is united with the wit of Congreve. Indeed, the wit of Sheridan, though equally brilliant with that of his celebrated predecessor, flows so easily, and is so happily elicited by the line of the dialogue, that, in admiring its sparkles, we never once observe the stroke of the flint which produces them. Wit and pleasantry seemed to be the natural atmosphere of this extraordinary man, whose history was at once so brilliant and so melancholy. Goldsmith was, perhaps, in relation to Sheridan what Vanburgh was to Congreve. His comedies turn on an extravagance of intrigue and disguise, and so far belong to the Spanish school. But the ease of his humorous dialogue, and the droll yet true conception of the characters, make sufficient amends for an occasional stretch in point of probability. If all who draw on the spectators for indulgence were equally prepared to compensate by a corresponding degree of pleasure, they would have little occasion to complain. The elder Colman's *Jealous Wife*, and some of his smaller pieces, are worthy, and it is no ordinary compliment, of being placed beside these masterpieces. We dare not rank Cumberland so high, although two or three of his numerous efforts retain possession of the stage. *The Wheel of Fortune* was certainly one of the best acting plays of its time, but it was perhaps chiefly on account of the admirable representative which the principal character found in Mr John Kemble.

The plays of Foote, the modern Aristophanes, who ventured, by his powers of mimicking the mind as well as the external habits, to bring living persons on the stage, belong to this period, and make a remarkable part of its dramatic history. But we need not dwell upon it. Foote was an unprincipled satirist; and while he affected to be the terror of vice and folly, was only anxious to extort forbearance-money from the timid, or to fill his theatre at the indiscriminate expense of friends and enemies, virtuous or vicious, who presented foibles capable of being turned into ridicule. It is a just punishment of this course of writing, that Foote's plays, though abounding in comic and humorous dialogue, have died with the parties whom he ridiculed. When they lost the zest of personality, their popularity, in spite of much intrinsic merit, fell into utter decay.

Meantime dramatic composition of the higher class seem-

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Drama. ed declining. Garrick in our fathers' time, Mrs Siddons in ours, could neither of them extract from their literary admirers any spark of congenial fire. No part written for either of these astonishing performers has survived the transient popularity which their talents could give to almost any thing. The truth seems to be, that the French model had been wrought upon till it was altogether worn out; and a new impulse from some other quarter—a fresh turning up of the soil, and awakening of its latent energies by a new mode of culture—was become absolutely necessary to the renovation of our dramatic literature. England was destined to receive this impulse from Germany, where literature was in the first luxuriant glow of vegetation, with all its crop of flowers and weeds rushing up together. There was good and evil in the importation derived from this superabundant source. But the evil was of a nature so contrary to that which had long palsied our dramatic literature, that, like the hot poison mingling with the cold, it may in the issue bring us nearer to a state of health.

The drama receives a new impulse from Germany.

The affectation of Frederic II. of Prussia, and of other German princes, for a time suppressed the native literature, and borrowed their men of letters from France, as well as their hair-dressers,—their dramas as well as their dressed dishes. The continental courts, therefore, had no share in forming the national drama. To the highest circle in every nation that of France will be most acceptable, not only on account of its strict propriety and conformity to *les convenances*, but also as securing them against the risk of hearing bold and offensive truths uttered in the presence of the sovereign and the subject. But the bold, frank, cordial, and rough character of the German people at large did not relish the style of the French tragedies translated for their stage; and this cannot be wondered at, when the wide difference between the nations is considered.

The natural character of the Germans is diametrically opposite to that of the French. The latter are light almost to frivolity, quick in seeing points of ridicule, slowly awakened to those of feeling. The Germans are of an abstracted, grave, and somewhat heavy temper; less alive to the ridiculous, more easily moved by an appeal to the passions. That which moves a Frenchman to laughter, affects a German with sorrow or indignation; and in that which touches the German as a source of the sublime or pathetic, the quick-witted Frenchman sees only subject of laughter. In their theatres the Frenchman comes to judge, to exercise his critical faculties, and to apply the rules which he has learned, fundamentally or by rote, to the performance of the night. A German, on the contrary, expects to receive that violent excitation which is most pleasing to his imaginative and somewhat phlegmatic character. While the Frenchman judges of the form and shape of the play, the observance of the unities, and the denouement of the plot, the German demands the powerful contrast of character and passion—the sublime in tragedy and the grotesque in comedy. The former may be called the formalist of dramatic criticism, keeping his eye chiefly on its exterior shape and regular form; the latter is the fanatic, who, disregarding forms, requires a deep and powerful tone of passion and of sentiment, and is often content to surrender his feelings to inadequate motives.

From the different temper of the nations, the merits and faults of their national theatres became diametrically opposed to each other. The French author is obliged to confine himself, as we have already observed, within the circle long since described by Aristotle. He must attend to all the decorum of the scene, and conform to every regulation, whether rational or arbitrary, which has been entailed on the stage since the days of Corneille. He

must never so far yield to feeling as to lose sight of grace and dignity. He must never venture so far in quest of the sublime, as to run the risk of moving the risible faculties of an audience, so much alive to the ridiculous, that they will often find or make it in what is to others the source of the grand or the terrible. The Germans, on the contrary, have never subjected their poets to any arbitrary forms. The division of the empire into so many independent states has prevented the ascendancy of any general system of criticism; and their national literature was not much cultivated, until the time when such authority had become generally unpopular. Lessing had attacked the whole French theatrical system in his *Dramaturgie* with the most bitter raillery. Schiller brought forward his splendid dramas of romance and of history. Goethe crowded the stage with the heroes of ancient German chivalry. No means of exciting emotion were condemned as irregular, providing emotion was actually excited. And there can be no doubt that the license thus given to the poet, the willingness with which the audience submitted to the most extravagant postulates on their part, left them at liberty to exert the full efforts of their genius.

Lessing, Schiller, and Goethe, became at once the fathers and the masters of the German theatre; and it must be objected to these great men, that, in the abundance of their dramatic talent, they sometimes forgot that their pieces, in order to be acted, must be adapted to the capabilities of a theatre; and thus wrote plays altogether incapable of being represented. Their writings, although affording many high examples of poetry and passion, are marked with faults which the exaggeration of their followers has often carried into total extravagance. The plays of chivalry and of history were followed by an inundation of imitations, in which, according to Schlegel, "there was nothing historical but the names and external circumstances; nothing chivalrous but the helmets, bucklers, and swords; and nothing of old German honesty but the supposed rudeness. The sentiments were as modern as they were vulgar; from chivalry pieces, they were converted into cavalry plays, which certainly deserve to be acted by horses rather than men." (Schlegel on the Drama.)

It is not the extravagance of the apparatus alone, but exaggeration of character and sentiment, which have been justly ascribed as faults to the German school. The authors appear to have introduced too harshly, brilliant lights and deep shadows; the tumid is too often substituted for the sublime; and faculties and dispositions the most opposed to each other are sometimes described as existing in the same person.

In German comedy the same faults predominate in a much greater degree. The pathetic comedy, which might be rather called domestic tragedy, became, unfortunately, very popular in Germany; and found a champion in Kotzebue, who carried its conquests over all the Continent. The most obvious fault of this species of composition is the demoralizing falsehood of the pictures which it offers to us. The vicious are frequently presented as objects less of censure than of sympathy; sometimes they are selected as objects of imitation and praise. There is an affectation of attributing noble and virtuous sentiments to the persons least qualified by habit or education to entertain them; and of describing the higher and better educated classes as uniformly deficient in those feelings of liberality, generosity, and honour, which may be considered as proper to their situation in life. This contrast may be true in particular instances, and being used sparingly, might afford a good moral lesson; but, in spite of truth and probability, it has been assumed, upon all occasions, by these authors, as the groundwork of a sort of intellectual jacobinism; consisting, as Mr Coleridge has well express-

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General character of the German drama.

Drama. ed it, "in the confusion and subversion of the natural order of things, their causes and their effects; in the excitement of surprise, by representing the qualities of liberality, refined feeling, and a nice sense of honour in persons and in classes of life where experience teaches us least to expect them; and in rewarding with all the sympathies that are the dues of virtue, those criminals whom law, reason, and religion, have excommunicated from our esteem."

The German taste was introduced upon the English theatre within these twenty years. But the better productions of her stage have never been made known to us; for, by some unfortunate chance, the wretched pieces of Kotzebue have found a readier acceptance or more willing translators, than the sublimity of Goethe, the romantic strength of Schiller, or the deep tragic pathos of Lessing. They have tended, however, wretched as the model is, to introduce on our stage a degree of sentiment, and awaken among the audience a strain of sensibility, to which we were previously strangers.

George Coleman's comedy of *John Bull* is by far the best effort of our late comic drama. The scenes of broad humour are executed in the best possible taste; and the whimsical, yet native characters, reflect the manners of real life. The sentimental parts, although one of them includes a finely wrought up scene of paternal distress, partake of the *false* pathos of German pathos. But the piece is both humorous and affecting; and we readily excuse its obvious imperfections, in consideration of its exciting our laughter and our tears.

Joanna
Baillie.

Whilst the British stage received a new impulse from a country whose literature had hitherto scarce been known to exist, she was enriched by productions of the richest native genius. A retired female, thinking and writing in solitude, presented to her countrymen the means of regaining the true and manly tone of national tragedy. She has traced its foundation to that strong instinctive and sympathetic curiosity, which tempts men to look into the bosoms of their fellow-creatures, and to seek, in the distresses or emotions of others, the parallel of their own passions. She has built on the foundations which she laid bare, and illustrated her precepts by examples which will long be an honour to the age in which they were produced and admired, yet its disgrace, when it is considered that they have been barred their legitimate sphere of influence upon the public taste.

Maturin,
Coleridge,
and others.

Besides this gifted person, the names of Coleridge, of Maturin, and other men of talents, throng upon our recollection; and there is one who, to judge from the dramatic sketch he has given us in *Manfred*, must be considered as a match for Æschylus, even in his sublimest moods of horror. It is no part of our plan, however, to enter upon the criticism of our contemporaries.¹ Suffice it to say, that the age has no reason to apprehend any decay of dramatic talent.

Neither can our actors be supposed inadequate to the representation of such pieces of dramatic art as we judge our authors capable of producing. We have lost Mrs Siddons and John Kemble, but we still possess Kean, Young, and Miss O'Neil; and the stage has to boast other tragic performers of merit. In comedy perhaps it was never more strong. In point of scenery and decoration, our theatres are so amply provided, that they may rather seem to exceed than to fall short of what is required to form a classical exhibition.

Where then are we to look for that unfortunate coun-

Drama. terbalance, which confessedly depresses the national drama, in despite of the advantages we have enumerated? We apprehend it will be found in the monopoly possessed by two large establishments, which, unhappily for the progress of national taste, and, it is said, without any equivalent advantage to the proprietors, now enjoy the exclusive privilege of dramatic representation. It must be distinctly understood, that we attribute these disadvantages to the *system* itself, and by no means charge them upon those who have the administration of either theatre. The proprietors have a right to enjoy what the law invests in them; and the managers have probably discharged their duty to the public as honourably as circumstances would admit of; but the system has led into errors which affect public taste, and even public morals. We shall briefly consider it as it influences, 1st, the mode of representation; 2dly, the theatrical authors and performers; and, 3dly, the quality and composition of the audience.

Drama. Bad consequences of the monopoly possessed by the London theatres.

The *first* inconvenience arises from the great size of the theatres, which has rendered them unfit for the legitimate purposes of the drama. The persons of the performers are, in these huge circles, so much diminished, that nothing short of the mask and buskin could render them distinctly visible to the audience. Show and machinery have therefore usurped the place of tragic poetry; and the author is compelled to address himself to the eyes, not to the understanding or feelings, of the spectators. This is of itself a gross error. Every thing beyond correct costume and theatrical decorum is foreign to the legitimate purposes of the drama, as tending to divide the attention of the audience; and the rivalry of the scene-painter and the carpenter cannot be very flattering to any author or actor of genius. Besides, all attempts at decoration, beyond what the decorum of the piece requires, must end in paltry puppet-show exhibition. The talents of the scene-painter and mechanist cannot, owing to the very nature of the stage, make battles, sieges, &c. any thing but objects of ridicule. Thus we have enlarged our theatres, so as to destroy the effect of acting, without carrying to any perfection that of pantomime and dumb show.

Secondly, The monopoly of the two large theatres has operated unfavourably both upon theatrical writers and performers. The former have been in many instances, if not absolutely excluded from the scene, yet deterred from approaching it, in the same manner as men avoid attempting to pass through a narrow wicket, which is perpetually thronged by an importunate crowd. Allowing the managers of these two theatres, judging in the first and in the last resort, to be possessed of the full discrimination necessary to a task so difficult; supposing them to be at all times alike free from partiality and from prejudice; still the number of plays thrust upon their hands must prevent their doing equal justice to all, and must frequently deter a man of real talents, either from pride or modesty, from entering a competition clogged with delay, solicitation, and other circumstances, *haud subeunda ingenio suo*. It is unnecessary to add, that increasing the number of theatres, and diminishing their size, would naturally tend to excite a competition among the managers, whose interest it is to make experiments on the public taste; and that this would infallibly secure any piece of reasonable promise a fair opportunity of being represented. It is by such a competition that genius is discovered; it is thus that horticulturists raise whole beds of common flowers, for the chance of finding among them one of those rare varieties which are the boast of their art.

¹ This and other similar expressions, which now excite a melancholy interest, are suffered to remain, for the reason stated in the note, page 147.

Drama

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Drammen.

The exclusive privilege of the regular London theatres is equally, or in a greater degree, detrimental to the performer; for it is with difficulty that he fights his way to a London engagement; and when once received, he is too often retained for the mere purpose of being laid aside, or *shelved* as it is technically called; that is, rendered a weekly burden upon the pay-list of the theatre, without being produced above four or five times in the season to exhibit his talents. Into this system the managers are forced, from the necessity of their situation, which compels them to enlist in their service every performer who seems to possess buds of genius, although it ends in their being so crowded together that they have no room to blossom. In fact, many a man of talent thus brought from the active exercise of a profession, to be paid for remaining inactive in obscurity in London, and supported by what seems little short of eleemosynary bounty, either becomes careless of his business or disgusted with it; and, at any rate, stagnates in that mediocrity to which want of exercise alone will often condemn talent.

Thirdly, and especially, the magnitude of these theatres has occasioned them to be destined to company so scandalous, that persons not very nice in their taste of society must yet exclaim against the abuse as a national nuisance. We are aware of the impossibility of excluding a certain description of females from public places in a corrupt metropolis like London; but in theatres of moderate size, frequented by the better class, these unfortunate persons would feel themselves compelled to wear a mask at least of decency. In the present theatres of London, the best part of the house is openly and avowedly set off for their reception; and no part of it that is open to the public at large is free from their intrusion, or at least from the open display of the disgusting improprieties to which their neighbourhood gives rise. And these houses, raised at an immense expense, are so ingeniously misconstrued, that in the private boxes you see too little of the play, and in the public boxes greatly too much of a certain description of the company. No man of delicacy would wish the female part of his family to be exposed to such scenes; no man of sense would wish to put youth of the male sex in the way of such temptation. This evil, if not altogether arising from the large size of the theatres, has been so incalculably increased by it, that, unless in the case of strong attraction, prostitutes and their admirers usually form the principal part of the audience. We censure, and with justice, the corruption of morals in Paris. But in no public place in that metropolis is vice permitted to bear so open and audacious a front as in the theatres of London. Barefaced vice is never permitted to insult decency. Those who seek it must go to the haunts to which it is limited. In London, if we would enjoy our most classical public amusement, we are braved by her on the very threshold.

We notice these evils, without pretending to point out the remedy. If, however, it were possible so to arrange interests, that the patents of the present theatres should

cover four, or even six, of smaller size, dedicated to the same purpose, we conceive that more good actors would be found, and more good plays written; and, as a necessary consequence, that good society would attend the theatre in sufficient numbers to enforce respect to decency. The access to the stage would be rendered easy to both authors and actors; and although this might give scope to some rant and false taste, it could not fail to call forth much excellence, that must otherwise remain latent or repressed. The theatres would be relieved of the heavy expense at present incurred, in paying performers who do not play; and in each maintaining three theatrical corps for the separate purposes of tragedy, comedy, and musical pieces; only one of which can be productive labourers on the same evening, though all must be supported and paid. According to our more thrifty plan, each of these companies would be earning at the same time the fruits of their professional industry. The hours of representation, in one or more of these theatres, might be rendered more convenient to those in high life, whilst the middling classes might enjoy a rational and classical entertainment after the business of the day.

Such an arrangement might indeed be objected to by those who entertain a holy horror of the very name of a theatre, and who imagine impiety and blasphemy are inseparable from the drama. We have no room left to argue with such persons, or we might endeavour to prove that the dramatic art is in itself as capable of being directed either to right or wrong purposes, as the art of printing. It is true, that even after a play has been formed upon the most virtuous model, the man who is engaged in the duties of religion will be better employed than he who is seated in a theatre, and listening to it. To those abstracted and enrapt spirits, who feel or suppose themselves capable of remaining constantly involved in heavenly thoughts, any sublunary amusement may justly seem frivolous. But the mass of mankind are not so framed. The Supreme Being, who claimed the seventh day as his own, allotted the other six days of the week for purposes merely human. When the necessity of daily labour is removed, and the call of social duty fulfilled, that of moderate and timely amusement claims its place, as a want inherent in our nature. To relieve this want, and fill up the mental vacancy, games are devised, books are written, music is composed, spectacles and plays are invented and exhibited. And if these last have a moral and virtuous tendency; if the sentiment expressed tend to rouse our love of what is noble, and our contempt of what is mean; if they unite hundreds in a sympathetic admiration of virtue, abhorrence of vice, or derision of folly; it will remain to be shown how far the spectator is more criminally engaged, than if he had passed the evening in the idle gossip of society, in the feverish pursuits of ambition, or in the unsated and insatiable struggle after gain—the graver employments of the present life, but equally unconnected with our existence hereafter. (D. D. D.)

DRAMBURG, a circle in Prussian Pomerania, in the government of Stralsund, extending over 550 square miles, and comprehending three cities, seventy-one villages, and ninety hamlets, with 21,285 inhabitants. The capital is a city of the same name, situated on the river Drage, and containing 277 houses and 1808 inhabitants, who make gloves and linen cloth.

DRAMMEN, a city of Norway, situated on the river of that name, in the province of Aggerhuus. It is an open city, well built, near a mile in length. It contains 900 houses

and 5412 inhabitants. The trade consists in making leather, oil, and sailcloth; in the export of timber and iron, and in the pursuit of the fishery. There are many vessels belonging to the port, but chiefly of small tonnage.

DRAN, HENRI-FRANÇOIS LE, a celebrated French surgeon, born at Paris in 1685, was the son of a surgeon of the same name, who, while serving with the army, had been distinguished for practical dexterity in the treatment of gunshot wounds. Young Le Dran entered on the surgical career under the auspices and direction of his father,

Drama

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Dran.

Drawing. and early attained to eminence in his profession. He became surgeon-major and demonstrator of anatomy at La Charité, member of the royal academy of surgery, consulting surgeon of the camps and armies of the king, and associate of the Royal Society of London. Apart from his professional pursuits, almost no particulars of his life have been preserved. He died at Paris on the 17th October 1770, at the advanced age of eighty-five. Le Dran was the author of a variety of works on surgery, of which we shall here subjoin a very brief account. 1. *Parallèle des différentes manières de tirer la Pierre hors de la Vessie*, Paris, 1730, 1740, 8vo, with plates; translated into German, Berlin, 1737, 8vo, and into English, London, 1738, 8vo. Le Dran, in this work, condemns the small, and shows himself a partizan of the large apparatus; recommending, however, that the incision should be made a little lower than Collot had been accustomed to make it, and that it should be of an extent sufficient to prevent the dilaceration of the bladder. He approves of the high apparatus only in the case where the bladder is sound and the calculus very voluminous. In order to obviate the too frequent lesion of the rectum in using the probe described by Albinus for the lateral operation of Rau, Le Dran invented a new sound, which enabled him to avoid such a casualty, and contributed materially to his success. 2. *Observations de Chirurgie, auxquelles on a joint plusieurs Reflexions en faveur des Etudiants*, Paris, 1731, 2 vols. 12mo: translated into German, Nuremberg, 1738, 8vo, and into English, 1739, 8vo. This collection is rich in facts well chosen, and reported with candour and precision. The author does not dissemble his faults, and speaks of his success without ostentation. 3. *Traité des opérations de Chirurgie*, Paris, 1731 and 1742, 8vo; London, 1749, 8vo, with additions by Cheselden. This work, in which the author ascribes an imaginary influence to the animal spirits, is nevertheless valuable, as containing an accurate description of a great number of operations, and many practical facts alike curious and interesting. If a

new method is spoken of, he never fails to indicate the author of the discovery. 4. *Reflexions pratiques sur les plaies d'armes à feu*, Paris, 1737, 1740, 1759, 12mo; Amsterdam, 1745, 12mo; Nuremberg, in German, 1740, 8vo. To the excellent precepts of Ambroise Paré, the author has here added the fruits of his own experience; and he has contributed to check in some cases the use, then too exclusive, of the seton. He has also advocated the method of large incisions, and justly proscribed the application of sindons or pledgets of linen soaked with brandy, in the first dressing of gunshot wounds. 5. *Suite du Parallèle de la Taille*, Paris, 1756, 8vo. 6. *Consultations sur la plupart des Maladies qui sont du ressort de la Chirurgie*, Paris, 1765, 8vo. 7. *Traité économique de l'Anatomie du corps humain*, Paris, 1768, 12mo. This work is full of superannuated hypotheses and material omissions. 8. *Récit d'une guérison singulière du plomb fondu dans la Vessie*, and *Lettre sur la dissolution du plomb dans cet organe*, Paris, 1749. Here Le Dran gives an account of his experiments for dissolving lead by means of mercury, and evinces great credulity in attributing to mercury certain imaginary qualities. Besides the works above enumerated, a great number of interesting observations by Le Dran may be found in the *Mémoires* of the Academy. (A.)

DRASTIC, in *Physic*, an epithet bestowed on such medicines as are of present efficacy, and potent in operation. It is commonly applied to emetics and cathartics.

DRAVE, a river, which, taking its rise near Innichen, in Tyrol, on the borders of Salzburg, traverses Carinthia and Styria, and after receiving the Mur at Legrad, and separating Croatia and Slavonia from Hungary, falls into the Danube below Essek. It is navigable from Villach in Carinthia. Some gold is collected from its bed by washing.

DRAWBACK, in commerce, certain duties, either of the customs or of the excise, allowed upon the exportation of some of our own manufactures, or upon certain foreign merchandises which have paid duty on importation. See **COMMERCE**.

D R A W I N G.

DRAWING is the art of representing forms upon a flat surface, by means of any sort of instruments, such as pencils, chalks, and the like. It is also a word used to denote the forms or contours of the figures in compositions, or in sculpture generally. Thus we say that the drawing in a picture, or the drawing of a statue, or any other figure, is of a high or an inferior kind, good or bad.

History. This art is well known to be of the most remote antiquity, and it has been in use amongst the most barbarous and most civilized nations for a variety of purposes. The hieroglyphic figures, whether carved or painted, upon the ancient Egyptian obelisks and temples, the ornaments of the same description upon their buildings and sarcophagi, together with the like productions amongst the Mexicans, prove the ancient origin of the art. Some of the purest and best of the Egyptian sculptures, and particularly the figures of the harpers, described and illustrated by Bruce the traveller, exhibit a knowledge and correctness of taste in the art far surpassing what is usually admitted, and show that the Greek school in this, as well as in their other acquirements, was greatly indebted to the Egyptians for pointing out the road to that excellence of form and dignity of character and expression which their matchless works possess.

Greece and Rome. Although examples of drawings by the Greeks have not come down to us, their magnificent statues assure us that their proficiency in the art must have been of the highest

order; and certain expressions of Pliny, in describing their pictures, evidently indicate that the Greeks must have attained to the utmost excellence in drawing, at the period of their glory as a nation. It is not our intention to load this article with ancient historical information respecting the fine arts, otherwise many curious anecdotes might be introduced; but we cannot pass over the mention of Alexander's emotion on seeing a picture of Palamedes when betrayed by his friends, which forcibly reminded the hero of his own treatment of Aristonicus; nor can we refrain from noticing the picture of Agamemnon and Iphigenia by Timanthes, so highly extolled by Cicero Quintilian, Valerius Maximus, and Pliny, as satisfactory proofs of the excellence of the ancients in drawing and painting, as well as in their sculptures and architecture. From the emotions which the higher excellencies of the pictures by the Greek artists produced in these gifted men, a fair inference may be drawn as to the perfection to which the art must have attained at the period of Grecian glory; and consequently drawing, even in the confined sense of the word, must have also been in a corresponding state of advancement. Their principal schools were at Sicyon, Rhodes, Athens, and Corinth; and when Greece was subdued by the Romans, the conquerors, alive to the benefits to be derived from the sciences and arts, encouraged the cultivation of them in their own capital, to which the

Drastic
||
Drawing.

Drawing. Greek artists resorted, and laid the foundation of the Roman school.

**Revival
of the
fine arts.**

From the conquests of Alaric and Attila in the fifth century, the arts lay prostrate and neglected, until their revival about the year 1450 at Florence, where Dominico Ghirlandaio, the master of Michel Angelo, practised painting with considerable reputation, which his pictures show he well merited.

**Michel
Angelo.**

We have now arrived at the golden age of the arts amongst the moderns, for Michel Angelo must be admitted to have been the first to discover and practise them with the classical discernment and skill which ultimately led him to the highest eminence amongst his contemporaries as a painter, a sculptor, an architect, and engineer, and deservedly placed his reputation on a level with the greatest names of antiquity. Till his time painters were considered as mere mechanics or labourers, and their employment was almost entirely confined to making representations of saints, and other figures used by the superstitious of the age. It was at this period, and surrounded by the wretched examples of such artists as Cimabue, Giotto, and others, that Michel Angelo, upon examining the torso of the Belvidere, instantly abandoned the barbarous taste and style of his master, and bounded into that sublime path which has been the admiration of all. "The poetry of the art," says Sir Joshua Reynolds, "he possessed in the most eminent degree; and the same daring spirit which first urged him to explore the unknown regions of the imagination, impelled him forward in his career beyond those limits which his followers, destitute of the same incentives, had not strength to pass. He was the bright luminary from whom painting has borrowed a new lustre, under whose hands it assumed a new appearance, and became another and superior art."

**Raffaello
Santio.**

Raffaello Santio, the pupil of Pietro Perugino, was born on Good Friday in the year 1483, and died on Good Friday in the year 1520, so that he only lived thirty-seven years. He must be admitted to have surpassed all the moderns in drawing and painting, though his design does not possess those sublime conceptions to be found in the works of his rival Michel Angelo. Generally speaking, the choice of his subjects is simple and pleasing, for he cared not to grapple with those severe attitudes and expressions to be found in the works of his gifted contemporary; but his compositions are invariably correct and harmonious, and his drawing careful, elegant, and pure. It is to his school that we would recommend the student to look for those examples which will be of the greatest practical benefit to him in drawing; a circumstance which ought to be his first and principal aim.

It is not the proper place here to enter into the history of painting in Italy after its revival by the two great masters whose names and characteristic excellencies we have just mentioned. This we reserve for the article PAINTING; and we now proceed to explain the practical details of the management and manipulation of drawing in its various styles.

Drawing, as we have already stated, is that part of the art which represents the forms of objects upon a flat surface, and may be divided into outlining and shading; and as the chief attributes of almost all objects are embraced in the correctness of their forms, the student of art should labour with the utmost pains and assiduity in order to acquire severe accuracy in his outline, without which the most dexterous shading and finishing will be worse than thrown away.

In whatever department the genius of the student may lead him to practise, habits of correctness will be most successfully cultivated by drawing the human figure, the knowledge of which is the basis of all true excellence.

Drawing. The study ought to be begun by copying the most simple parts, such as we have exhibited in Plates CXC., CXCI., CXCII., CXCIII.; and the greatest anxiety to attain accuracy in the gentle undulations of form ought to be evinced. We would recommend that perspective should be studied at the earliest stage of the pupil's practice. By means of a knowledge of its rules, which are simple, much time will be spared to the student, and excellence more speedily acquired than when directed only by his eye in the practice of drawing, whatever the object may be.

Although it matters little what the instrument may be which is used in the practice of drawing, yet, upon the whole, in chalk, we would recommend black and white chalks as the most to be preferred. They are easily procured, and convenient for use. They are usually fixed in an instrument of brass or steel, as represented below, the white chalk being placed at the one end, and the black at the other.



The paper should be slightly tinged with colour, so that the white chalk which is put upon the lights may tell properly. Crayon paper is the best. The outline being carefully made, first with charcoal as slightly as possible, and then corrected and smoothed with the black chalk, the shading may be executed as the taste of the student inclines. It may either be done with careful hatchings at particular angles, or in one solid smooth mass, or by a combination of both, which is probably the most advisable mode of practice. Too much attention to elaborate hatchings may divert the attention of the student from the more essential excellencies of the outline, and proper balance of light and shade; and a too careless manner in using his materials may lead to equal disadvantages, for in art, as in every thing else, carelessness in the beginning can never lead to excellence in the end. Much time in laying in the shadows may be spared by using an instrument called a stump, made of a piece of shamois leather rolled up in a cylindrical form, in a tight manner, tied round with thread, and shaped to a blunt point, as represented below.



A little chalk-powder may be dusted upon the shadow if extensive, and rubbed in with the instrument above described, and afterwards the part finished up with the chalk. The white chalk should not be used until the drawing is completed with the black, otherwise it is apt to get injured by admixture, which in no instance should be the case, for there ought always to be a space between the two chalks occupied by the tint of the paper.

The black chalk will be found to work very well upon white as well as coloured paper; but the process is more tedious, in consequence of all the middle or light tints having to be attended to and executed, which, in the case of the other paper, the tint produces. Errors in outline or shading may be rectified by rubbing out the defect with a piece of bread squeezed into a convenient shape between the finger and thumb.

After the student has acquired some degree of proficiency in using the chalk, and imitating any drawing or print which may be given him, he should next begin to copy from real substances, or what is technically termed drawing from "the round."

Here a wide field is opened up to him in the study of

Drawing. the antique statues; and while striving to attain accuracy in copying these noble reliques of art, he should consider deeply their high character and expression. It is not to be expected that a very extensive set of examples of the antique, or a discussion and detail of their merits, can be given here; all that we can do is to lead the student to the proper source whence he may draw supplies; and with this view we would recommend him to peruse and contemplate the statues of the Apollo Belvidere, the Venus de' Medici, the Gladiator Borghese, the Torso of the Belvidere, and the matchless group of the Laocoon, at the time he is copying them in the way of practice. See Plates CXCIV., CXCV., CXCVI., CXCVII., CXCVIII.

Red chalk. We have hitherto only considered the drawing of the human figure, and that in black and white chalks. Another very good way of producing a spirited effect is, by a union of both these with red chalk, a method much practised by the old masters in their academy figures, &c.

Measure-ment of the human figure. The following are the measures of the human body, as taken by Fresnoy from the ancient statues. The ancients have commonly allowed eight heads to their figures, though some of them have allowed but seven. The figure is ordinarily divided into ten faces; that is to say, from the crown of the head to the sole of the foot, in the following manner:

From the crown of the head to the forehead is the third part of a face.

The face begins at the root of the lowest hairs which are upon the forehead, and ends at the bottom of the chin.

The face is divided into three proportionable parts, the first contains the forehead, the second the nose, and the third the mouth and the chin; from the chin to the pit betwixt the collar-bones is two lengths of a nose.

From the pit betwixt the collar-bones to the bottom of the breast one face.

From the bottom of the breast to the navel one face.

From the navel to the genitories one face.

From the genitories to the upper part of the knee two faces.

The knee contains half a face.

From the lower part of the knee to the ankle two faces.

From the ankle to the sole of the foot half a face.

Drawing. A man, when his arms are stretched out, is from the longest finger of his right hand to the longest finger of his left, as broad as he is long.

From one side of the breast to the other, two faces.

The bone of the arm, called humerus, is the length of two faces from the shoulder to the elbow.

From the end of the elbow to the root of the little finger, the bone called cubitus, with part of the hand, contains two faces.

From the box of the shoulder-blade to the pit betwixt the collar-bones, one face.

If you would be satisfied in the measure of breadth from the extremity of one finger to the other, so that this breadth should be equal to the length of the body, you must observe that the boxes of the elbows with the humerus, and of the humerus with the shoulder-blade, bear the proportion of half a face when the arms are stretched out.

The sole of the foot is the sixth part of the figure.

The hand is the length of a face.

The thumb contains a nose.

The inside of the arm, where the muscle disappears which makes the breast (called the pectoral muscle), to the middle of the arm, four noses.

From the middle of the arm to the beginning of the head five noses.

The longest toe is a nose long.

The utmost parts of the teats and the pit betwixt the collar-bones of a woman make an equilateral triangle.

For the breadth of the limbs no precise measures can be given, because the measures themselves are changeable, according to the quality of the persons, and according to the movement of the muscles.

The best example of the measures of an ancient statue are by Audran, an author whom Sir Joshua Reynolds recommends as being the most useful; and on this department of our subject we now add the following table of the measurements and comparisons of the three celebrated statues of the Apollo, the Venus, and the Hercules, as published by Volpato and Morghen at Rome, in a work called *Il Principi del Disegno*. To preserve uniformity in the measurements, the head of each figure is divided into twelve parts, and each part into six minutes.

	APOLLO.	VENUS.	HERCULES.
	Parts. Min.	Parts. Min.	Parts. Min.
From the beginning of the head to the root of the hairs.....	3 0	3 0	3 0
From the root of the hairs to the eyebrows, or beginning of the nose.....	3 0	3 0	3 0
From the eyebrows to the end of the nose.....	3 0	3 0	3 0
From the end of the nose to the bottom of the chin.....	3 0	3 0	3 0
From the chin to the articulation of the clavicle with the sternum.....	5 1	4 3½	6 0
From the clavicle to the end of the breast.....	9 3½	10 5	9 4
From the end of the breast to the middle of the umbilicus.....	10 5½	8 2	10 4
From the umbilicus to the symphysis pubis.....	7 4½	11 4½	8 2
From the symphysis pubis to the middle of the patella.....	24 0	18 2	23 3
From the middle of the patella to the beginning of the flank.....	28 2	27 3	30 1½
From the same to the swell of the foot.....	23 3½		
From the swell of the foot to the end of the figure, or to the ground.....	4 4		
From the patella to the ground.....		25 3	
From the patella to the end of the heel of the right leg.....			29 2½
The length of the sole of the foot.....	14 1½		
The highest part of the foot from the ground.....		3 5½	6 1½
From the instep to the end of the toes.....		9 0½	10 1½
From the clavicle or collar-bone to the beginning of the deltoid muscle.....	9 0	6 3	
The length of the whole clavicle on the right side.....			14 1
From the clavicle to the nipple.....	10 4½	6 0½	10 4
From one end of the breasts to the other.....	15 0	11 2	15 1½
The greatest breadth of the trunk, taken a little below the beginning of the thorax.....	18 3		22 4

Drawing.

Drawing.

	APOLLO.		VENUS.		HERCULES.	
	Parts.	Min.	Parts.	Min.	Parts.	Min.
The breadth of the trunk from the end of the breast.....			15	4½		
The narrowest part of the same, taken at the beginning of the flank.....	15	3	15	1	19	3½
The greatest breadth of the ossa ilei, where the flanks project most.....	16	4	17	5	21	1½
From the highest part of the deltoid muscle to the end of the biceps.....	17	0½				
From the beginning of the os humeri to the cubit.....			20	2	22	1½
From the end of the biceps to the beginning of the hand.....	16	0	14	0	15	1½
The greatest breadth of the fore-arm in front.....	4	5	5	0	8	2
The greatest breadth of the arm in front.....	5	3	4	5	6	1
Breadth of the pulse of the arm in front.....					5	1
The greatest breadth from one trochanter to the other.....	17	5	19	3	22	0
The greatest breadth of the thigh in front.....	9	2½	9	5		
The greatest breadth of the left thigh.....					11	0½
The greatest breadth of the knee opposite the middle of the patella.....	5	3½	5	0	6	4
The greatest breadth of the calf of the leg.....	6	3½	6	3½	7	5½
The greatest breadth between the inner and outer ankle.....	4	0½	4	0	4	3
The narrowest part of the foot.....	3	3	3	3	3	5
The broadest part of the same.....	5	0	5	1	6	4½
From the last vertebra of the neck to the lower part of the os sacrum.....					38	4
From the end of the os sacrum to the end of the glutæus.....					6	4
From the end of the glutæus to the beginning of the gastrocnemius muscle.....					15	4
From the beginning of the gastrocnemius to the end of the figure.....					30	1

In the foregoing table, we by no means have set down the ancient formula as an infallible guide, since the changes which the human form undergoes from infancy to old age preclude the possibility of limiting its measurements to definite proportions, and much depends upon the order or rank of the figure to be represented. Thus the Apollo Belvidere and the Venus de' Medici have more than ten faces in their length; and in other respects these figures, which by their authors were intended to represent divinities, are considerably different in their proportions from others of the antique statues. It is enough if something approximating to accuracy of measurement be kept in view when the student is engaged in making his drawing; and this he should do without the use of compasses or any other mathematical means, which ultimately cramp his powers of imitation, and retard his progress towards perfection.

Light and shade are the means by which the actual appearance of substance in the object represented is conveyed, and they should be studied with every attention, from the objects themselves which are assumed as the models for imitation. No rules can be laid down so good as the study of nature herself, and no language can explain the beauties of her varied appearances of lights, shadows, or reflections.

It is by means of light and shade also that the figures in a picture or composition are made to keep their proper places: thus the principal figure is generally illuminated with the strongest and broadest light, and the others kept subordinate. It is with considerable diffidence, however, that we state this as the practice most to be approved of: every artist, and indeed every school, has a peculiar mode of management in this, and we are aware that a different practice has often produced excellent results.

The general rule with regard to the relative proportions of light, shadow, and middle tint in a well-ordered effect is, that there should be rather more shadow than light, and more middle tint than either of the former, provided the subject does not require a different arrangement. In the infinite variety of forms of composition of the various schools, rules for the attainment of excellence can hardly be laid down with safety; and we must on this account refer the student to the contemplation of the works of the most esteemed masters, for examples to direct him in the practice of the chiar' oscuro of his pictures.

The study of anatomy is of the utmost importance to-

wards a correct knowledge of the human figure, and is most beneficial in leading the way to an accurate representation of its various parts and attitudes. Without it no proper estimate can be formed of the movements of the joints of the limbs, nor of the swellings and undulations of the muscles, which, when in action, are constantly varying, and must be seized at the moment. It was by the careful study of this branch of science that Michel Angelo, Leonardo da Vinci, and other eminent artists, attained to such excellence in representing the forms when engaged in action, and displayed that accuracy of outline and show of energy which appear in the various members of their figures.

The most necessary preparation for all drawings executed with Indian ink, sepia, bistre, or the like, is an accurate outline, which should be made with a black-lead pencil, or ink, sepia, pen and ink if the work is only meant to be finished in a sketchy manner. Care must be taken in both to regulate the strength of the touch or line by the nearness or distance of the object represented. The shades should be laid in a good deal lighter at first than they are intended to be when the drawing is finished, and the hard edges of the touches softened with a water brush. The greater the attention paid to the subject as a whole in this stage, and the broader and less minute the washes are laid on, the better; for it is only as the drawing advances towards completion that the minutiae should be attended to. In Plate CCI. we have given an example of the method of proceeding with a drawing washed in with one colour only. Fig. 1 exhibits the outline; fig. 2 the first broad wash; fig. 3 the second working; and fig. 4 the finished drawing. Each shading should be allowed to dry thoroughly before the succeeding wash is laid on; and there are many modes, we had almost said tricks, by which certain excellent effects are produced, which are only to be acquired by practice. Thus the use of a sharp pointed penknife will be found most serviceable in taking out irregularly-formed lights in the foreground; and much advantage will be found in wiping out lights and middle tints with a towel or handkerchief during the progress of the work; but regarding these no rules can be laid down. The artist must use his own discretion; though too much of such practice is not to be recommended.

The study of landscape ought to be commenced by imitating the most simple forms, as in the following figures.

Drawing in Indian ink, sepia, bistre, or the like.

Light and shade, or chiar' oscuro.

anatomy.

Drawing.

Fig. 1.



Fig. 3.

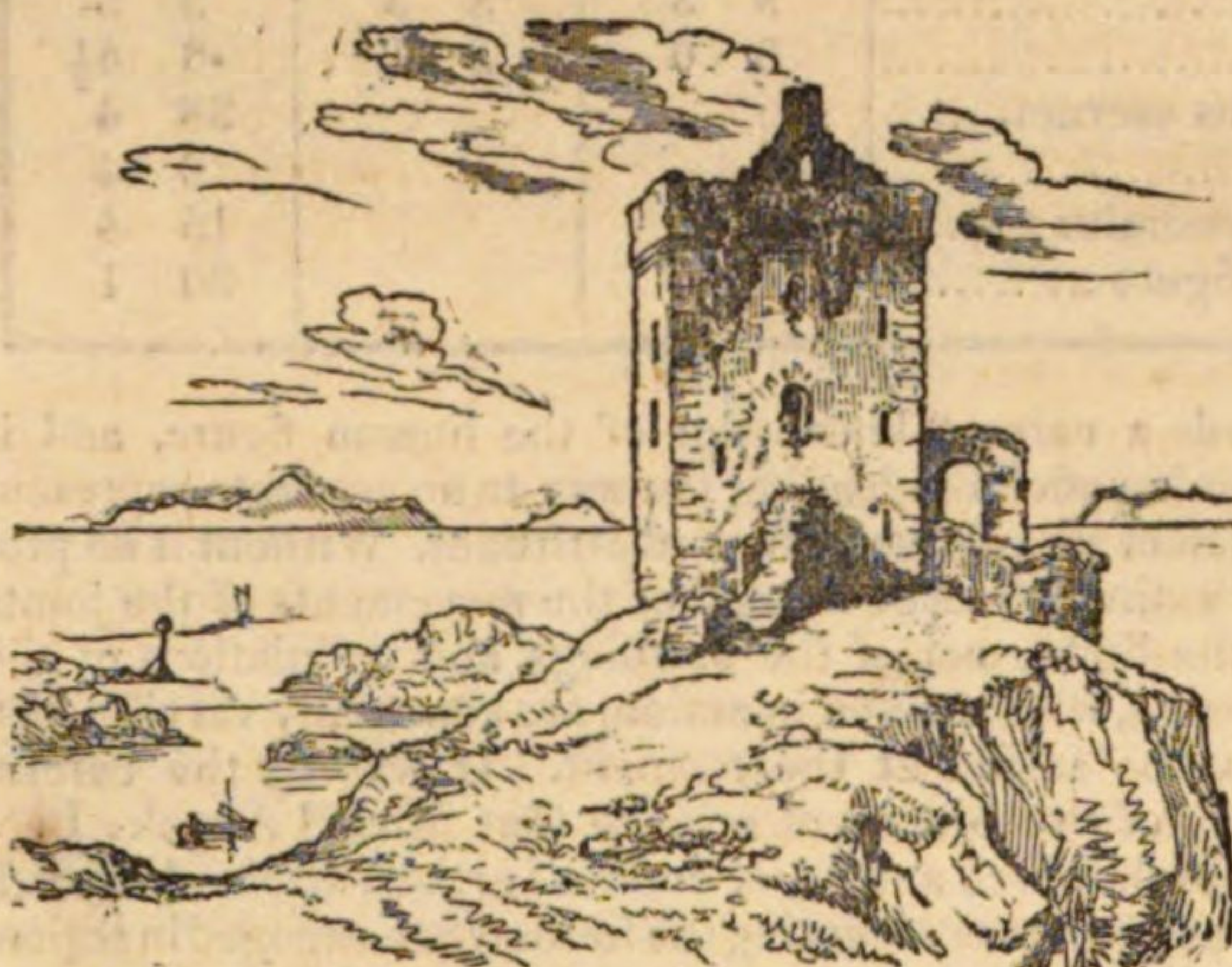


Fig. 2.

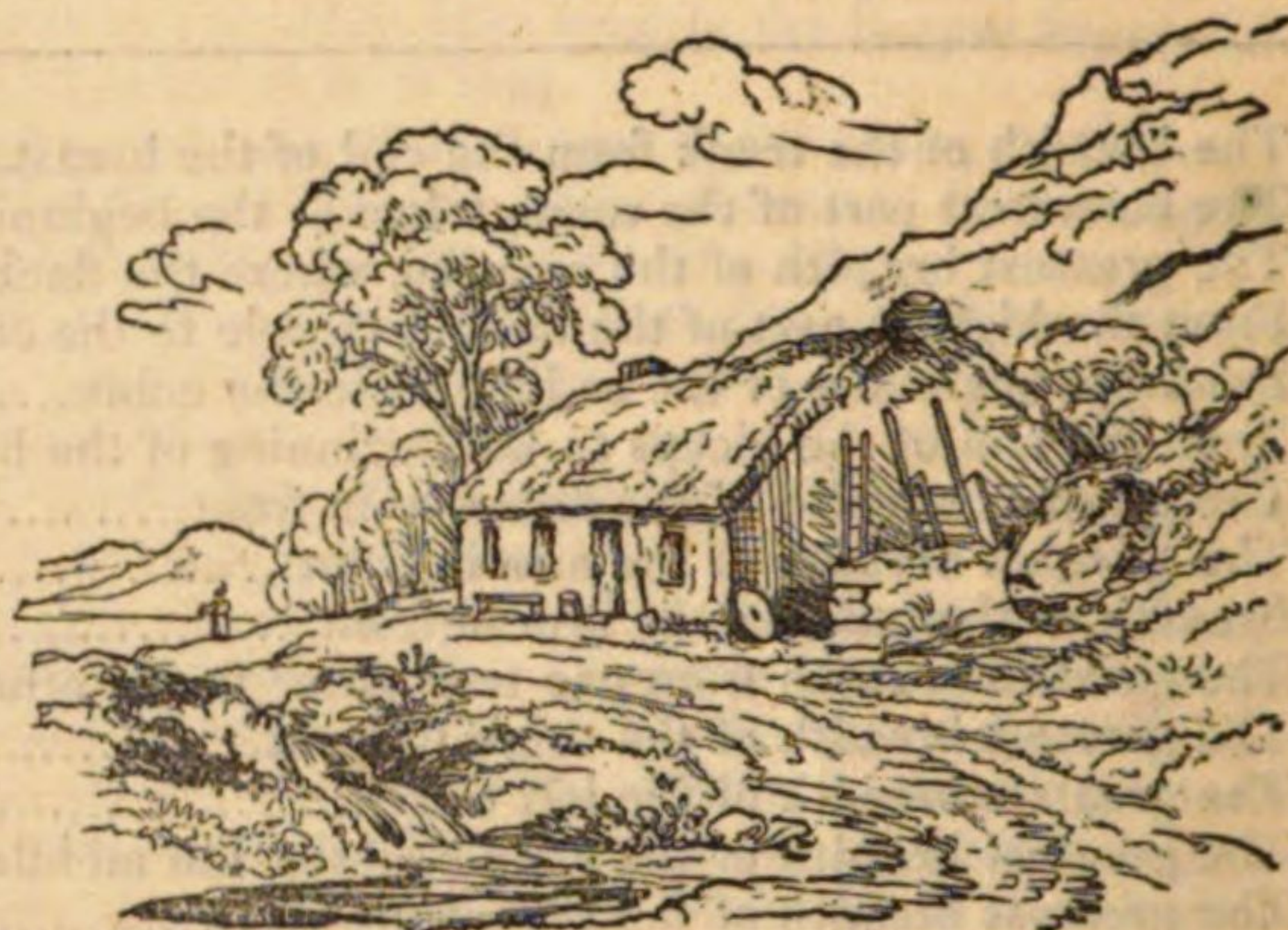


Fig. 4.



These or similar figures may be copied two or three times over before attempting such a work as we have given in Plate CCI. Plate CC. exhibits two examples of the style of sketching landscape by Claude; and we strongly recommend Turner's *Liber Studiorum* to the careful perusal of the young artist in this department. The studies of the human figure by Raffaele, Parmegiano, and others, or their imitations by Rodgers, are the best.

There is no branch of the art in which such a variety of means may be adopted for attaining the same end, namely, the imitation of nature, as in water-colour drawing; consequently we shall not attempt to lay down particular rules for the guidance of the student. Practice, as we have already stated, is the only means of arriving at the wished-for perfection; we shall therefore limit our notice to a few of the details most in use among painters in water colours.

The substances used in painting in water colours are to be had in all the shops in prepared cakes, which are rubbed down upon a stone pallet or plate with a little water. The paper upon which the drawing is to be made may be either smooth or rough; and if greasy on the surface, so that the colours do not adhere pleasantly, it may be sponged over, or the colours may be mixed with a little ox-gall, either in its native or prepared state. One drop of gall in the former condition, or the size of a large pin head in the latter, will be enough to saturate a tea-cupful of water for the purpose of mixing with or softening off the colours.

The paints chiefly used are ultra-marine blue, indigo, Antwerp and cobalt blues, gamboge, ochre, Indian, and crome yellows, Indian red, vermilion, lake, carmine, burnt ochre, and brown pink reds; and although these may be denominated the primaries out of which all other modifications of tints can be made up, yet we may add to them a number of

browns which will be found to be serviceable, such as terra di sienna, both raw and burnt, Vandyke brown, umber, sepia, &c.

The paper ought to be stretched upon a drawing board or frame, which is effected by soaking it in water, or by sponging it over on both sides, then removing the superabundant water with a piece of blotting paper or towel, and afterwards folding back the edge for about an inch all round, and applying the paste to the folded portion, and also to that part of the drawing board which the paper is to adhere to. The part so pasted should be pressed strongly, or the finger may be dipped into the paste and rubbed upon the pasted edge, and then the paper sponged all over, that the pasted edge may be permitted to dry more quickly than the centre part. Care must be taken not to let any of the paste touch the middle of the paper, which would destroy the drawing when cut from the board.

Whatever may be the subject, it will be advisable to begin with light colour, and gradually work up both effect of light and shadow, and strength of tint, in a broad manner, without much attention to minutiae, as already described in Indian ink drawing. The earlier water-colour painters were in the practice of working with a gray or neuter tint at the commencement of their drawings; and as this method is very simple, it will be the best for beginners, though in the end there will not be produced that richness of effect, and freshness, depth, and warmth of colour, which is the result of the contrary practice of the best masters of the present day; we mean the laying on of the colours almost at once, without any under preparation of neuter tint. In landscape painting, the paper where the sky is represented ought to be well soaked with water from a sponge, and afterwards dried moderately with a towel or piece of bibulous paper, to make the tints lie on

Drawing
in water
colours.

Paper.

Ox gall.

Colours.

Drawing.

Pasting
the paper
on the
board or
frame.

Dray
||
Drayton.
Fore-
ground.

more solidly. The tints are then to be blended into each other while the surface is damp, and this should be done with large brushes. After the sky and distance are laid in, the middle and foregrounds should be added, and the details worked out as the taste or ability of the artist may lead him, for it is impossible to prescribe rules where no two artists follow the same practice.

Ultra-
marine.

The appearance of air may be given to the distance by washes of ultramarine or other semi-transparent colours; and the spaces where sharp distinct lights are situated may be scraped out with a pen-knife, or the touches may be laid in with clean water, and after being allowed to remain upon the paper for a minute or less, they may be rubbed out with a piece of stale bread. Another mode of leaving out the lights is to touch the places with pipe-clay, used in a liquid state, with a camel's hair pencil, and afterwards the colour may be freely laid over them; the parts where the clay is laid have then only to be rubbed with bread or Indian rubber, to remove the tint, and expose the clean paper. Should any error, either in outline or effect of chiar' oscuro, have been committed, the whole space can be removed with a sponge and water, without much injury to the paper; indeed many of the best artists of the present day rub out and lay in their colours almost alternately, by which means a very great variety of surface and tint is obtained which could not be effected by any other practice.

Removing
of errors.

We have thus endeavoured to give what we hope will be found a satisfactory account of practical drawing, whether in chalk or water colour; and it now remains for us to recommend, for the student's careful perusal, *Leonardo da Vinci on Painting*; the works of Sir Joshua Reynolds; *Burnet on Light and Shadow in Painting, on Colour in Painting, on Composition in Painting*; the works of the old masters, whether their drawings or etchings; and, above all, the study of nature. Every one who has long been in the habit of copying from drawings alone, of whatever description, must have felt considerable diffidence in attempting to draw from real objects or from nature. This arises from the fear of being unable properly to reduce and hold in their relative place, on a sheet of paper, the objects which present themselves to the eye. To remove this obstacle, we would recommend that too much should not be attempted at the first, but the most simple subjects chosen, and these represented in a careful manner; the outline on the light side of the objects to be done in a delicate manner, and that on the shadow side in a bold style, and the shading to be also conducted upon similar principles. The most careful attention to representing the various forms should be practised in the outline, for on the accuracy of it depends the balance or fitness of the whole design or picture. By thus habituating the eye to a correct delineation of the parts, it has little difficulty in

Drawing
from na-
ture.

coming at the power of representing the general effect and appearance of the whole; and thus a picture, whether consisting of figures, rocks, trees, or marine objects, is managed with comparative ease; while, on the other hand, when a design has been commenced without due attention to the outline and balance of the objects, a loose and disjointed performance is produced.

Drayton.

Many other difficulties present themselves at first to the anxious student, and not the most unimportant is the feeling which seizes him upon the contemplation of works of excellence when seen in a finished form; but let him not despond; for much pains have been used, and great and palpable errors committed, even by the most accomplished masters, in the details of their works, which, the more accurate they are, the greater has been the difficulty encountered. As an illustration of this, we have thought it proper to direct attention to the variety of lines used to represent the objects of Plate CXCIX., taken from a sketch by Raffaele. The subject is the study for a portion of the picture of the School of Athens, and contains much valuable information to the learner respecting the progress of this great master in the management of his compositions, of one of the most important of which this is the first rough sketch.

Description of the Plates.

Plate CXC. Initiatory lessons for drawing the various parts of the face. Figs. 1, 2, 3, represent the human eye in a variety of positions. Figs. 4 and 5 the nose. Figs. 6, 7, 8, the nose and mouth.

Plate CXCI. Second lesson. Figs. 1 and 2, the ear. Figs. 3, 4, 5, studies of heads.

Plate CXCII. Plate of male and female hands in a variety of positions, as represented in figures 1 to 11.

Plate CXCIII. contains eight figures or studies of the human foot.

Plate CXCIV. Studies from the antique. Fig. 1, Thalia; fig. 2, Clio; both examples of sitting figures. Fig. 3, Bacchus. Fig. 4, Venus of Arles. Fig. 5, a Discobolus.

Plate CXCV. Studies from the antique. Fig. 1, Hercules and Telephus. Fig. 2, the Torso of Michel Angelo. Fig. 3, Jason. Fig. 4, the Dying Gladiator.

Plate CXCVI. Studies from the antique. Fig. 1, Venus de' Medicis. Fig. 2, Venus of the Capitol.

Plate CXCVII. Study from the antique. Fig. 1, the Apollo Belvidere.

Plate CXCVIII. Study from the antique. Fig. 1, Group of the Laocoon.

Plate CXCIX. Specimen of sketching by Raphael.

Plate CC. Specimens of sketching by Claude Lorraine.

Plate CCI. Example of the mode of conducting a drawing in Indian ink, bistre, sepia, &c., from outline to finished performance.

(G. G. G.)

DRAY, a kind of cart used by brewers for carrying barrels of beer or ale; also a sledge drawn without wheels.

DRAY, among sportsmen, denotes squirrel nests built on the tops of trees.

DRAYTON, MICHAEL, an eminent English poet, was born at Harshull, in the parish of Atherston, in 1563, and was descended of an ancient family in Warwickshire. His propensity to poetry showed itself even from his infancy; and we find that his principal poems had been published, and he himself distinguished as a poet, by the time he had attained about thirty years of age. It appears from his poem of *Moses's Birth and Miracles*, that he was a spectator at Dover of the Spanish Armada; and it is not improbable that he was there engaged in some military employment. It is certain, indeed, that, owing both to his merit as a

WOL. VIII.

writer and to his valuable qualities as a man, he was held in high estimation, and warmly patronized by several personages of consequence, particularly by Sir Henry Goodere, Sir Walter Aston, and the Countess of Bedford, to the first of whom he owns himself indebted for the greater part of his education, whilst by the second he was for many years supported. Amongst his poems the most celebrated is the *Poly-Olbion*, a chorographical description of England, with its productions, antiquities, and curiosities, in dodecasyllabic verse. This he dedicated to Prince Henry, by whose encouragement it was written; and whatever may be thought of the poetry, his descriptions are allowed to be exact. In 1626 we find him styled poet-laureat in a copy of verses written in commendation of Abraham Holland; but as Ben Jonson then held that office, it is to be

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Dreams. understood in a loose sense as a term of commendation; and, in fact, it was bestowed on others as well as Drayton, without being confined strictly to the office commonly known by that appellation. He died in 1631; and was buried amongst the poets in Westminster Abbey, where his bust is still to be seen, with an epitaph penned by Ben Jonson.

DREAMS are all those thoughts which pass through the mind, and those imaginary transactions in which we often fancy ourselves engaged when in the state of sleep.

Scarcely any part of nature is less open to our observation than the human mind in this state. The dreamer himself cannot well observe the manner in which dreams arise or disappear in his own mind. When he awakes, he cannot recollect the circumstances of his dreams with sufficient accuracy. Were we to watch over him with the most vigilant attention, we could not perceive with certainty what emotions were excited in his mind, or what thoughts passed through it, during his sleep. But though we could ascertain these phenomena, many other difficulties would still remain. What parts of a human being are active, and what dormant, when he dreams? Why does he not always dream while asleep? Or why dreams he at all? Do any circumstances in our constitution, situation, and peculiar character, determine the nature of our dreams?

In treating of this subject, we shall endeavour to lay before our readers such facts as have been ascertained concerning dreaming, together with the most plausible conjectures which have been offered to explain the phenomena of dreams.

In dreaming we are not conscious of being asleep. This is well known from a great variety of circumstances. When awake, we often recollect our dreams; and we remember, on such occasions, that whilst those dreams were passing through our minds, it never occurred to us that we were separated by sleep from the active world. Persons are often observed to act and talk in dreaming as if they were busily engaged in the intercourse of social life.

In dreaming we do not consider ourselves as witnessing or bearing a part in a fictitious scene. We seem not to be in a similar situation with the actors in a dramatic performance, or the spectators before whom they exhibit, but engaged in the business of real life. All the varieties of thought that pass through our minds when awake may also occur in dreams; all the images which imagination presents in the former state may be called up in the latter; the same emotions may be excited, and we are often actuated by equal violence of passion; none of the transactions in which we are capable of engaging whilst awake is impossible in dreams; in short, our range of action and observation is as wide in the one state as in the other; and whilst dreaming, we are not sensible of any distinction between our dreams and the events and transactions in which we are actually concerned in our intercourse with the world.

It is said that all men are not liable to dream. Dr Beattie, in a very pleasing essay on this subject, relates that he knew a gentleman who never dreamed except when his health was in a disordered state; and Locke mentions that a certain person of his acquaintance was almost a stranger to dreaming until the twenty-sixth year of his age, when he began to dream in consequence of having had a fever. These instances, however, are too few, and we have not been able to obtain more; and, besides, it does not appear that those persons had always attended, with the care of a philosopher making an experiment, to the circumstances of their sleep. They might dream, but not recollect their dreams on awaking; and they might both dream and recollect their dreams immediately upon awaking, yet afterwards suffer the remembrance of them to slip out of their memory. We do not advance this,

Dreams. therefore, as a certain fact concerning dreaming; we are rather inclined to consider it as a mistake. But though it appears to be by no means certain that any of the human race are throughout the whole of life absolute strangers to dreaming; yet it is well known that all men are not equally liable to dream. The same person dreams more or less at different times; and as one person may be more exposed than another to those circumstances which promote this exercise of fancy, one person may therefore dream more than another. The same diversity will naturally take place in this as in other accidents to which mankind are in general liable.

Though in dreams imagination appears to be free from all restraint, and indulges in the most wanton freaks, yet it is generally agreed that the imaginary transactions of the dreamer bear always some relation to his particular character in the world, his habits of action, and the circumstances of his life. The lover, we are told, dreams of his mistress, the miser of his money; the philosopher renews his researches in sleep often with the same pain and fatigue as when awake; and even the merchant at times returns to balance his books, and computes the profits of an adventure, when slumbering on his pillow. And not only do the more general circumstances of a person's life influence one's dreams; the passions and habits are nearly the same when asleep as when awake. A person whose habits of life are virtuous, does not in his dreams plunge into a series of crimes; nor are the vicious reformed when they pass into this imaginary world. The choleric man finds himself offended by slight provocations in his dreams as well as in his ordinary intercourse with the world; and a mild temper continues pacific even in sleep.

The character of a person's dreams is influenced by his circumstances when awake in a still more unaccountable manner. Certain dreams usually arise in the mind after a person has been in certain situations. Dr Beattie relates that once, after riding thirty miles in a high wind, he passed a part of the succeeding night in dreams beyond description terrible. The state of a person's health, and the manner in which the vital functions are carried on, have a considerable influence in determining the character of dreams. After too full a meal, or after eating of an unusual sort of food, a person is very apt to be harassed with uncomfortable dreams.

In dreaming, the mind for the most part carries on no intercourse through the senses with surrounding objects. Touch a person gently who is asleep, and he feels not the impression. You may awake him by a smart blow; but when the stroke is not sufficiently violent to awake him, he remains insensible of it. We speak softly beside a person asleep, without fearing that he will overhear us. His eyelids are shut; and even though light should fall upon the eyeball, yet still his powers of vision are not wakened to active exertion, unless the light be strong enough to rouse him from sleep. He is insensible both to sweet and to disagreeable smells. It is not easy to try whether his organs of taste retain their activity, without awakening him; yet from analogy it may be presumed that these too are inactive. With respect to the circumstances here enumerated, it is indifferent whether a person be dreaming or buried in deep sleep.

Yet there is one remarkable fact concerning dreaming, which may appear contradictory of what has been here asserted. In dreams we are liable not only to speak aloud in consequence of the suggestions of imagination, but even to get up and walk about, and engage in little enterprises, without awaking. Now, as we are in this instance so active, it seems that we cannot be then insensible of the presence of surrounding objects. The sleep-walker is really sensible in a certain degree of the presence of the objects

Dreams. around him; but he does not attend to them with all their circumstances, nor do they excite in him the same sensations as if he were awake. He feels no terror on the brink of a precipice, and in consequence of being free from fear, he is also without danger in such a situation, unless suddenly awaked. This is one of the most inexplicable phenomena of dreaming.

There is also another fact not quite consonant with what has been above mentioned. It is said that in sleep a person will continue to hear the noise of a cataract in the neighbourhood, or regular strokes with a hammer, or any similar sound sufficiently loud, and continued uninterruptedly from before the time of his falling asleep. We know not whether he awakes on the sudden cessation of the noise; but the fact is asserted on apparently sufficient evidence, and it is curious. Even when awake, if very deeply intent on any piece of study, or closely occupied in business, the sound of a clock striking in the neighbourhood, or the beating of a drum, will escape us unnoticed; and it is therefore the more surprising that we should thus continue sensible to sounds when asleep.

Not only do a person's general character, habits of life, and state of health, influence his dreams; but those concerns in which he has been most deeply interested during the preceding day, and the views which have arisen most frequently to his imagination, very often afford the subjects of his dreams. When we look forward with anxious expectation towards any future event, we are likely to dream either of the disappointment or the gratification of our wishes. If we have been engaged throughout the day either in business or amusements which we have found exceedingly agreeable, or in a way in which we have been extremely unhappy, either our happiness or our misery is likely to be renewed in our dreams.

Though dreams have been regarded amongst almost all nations of the world, at some periods of their history, as prophetic of future events, yet it does not appear that this popular opinion has ever been established on any good grounds. Christianity, indeed, teaches us to believe that the Supreme Being may, and actually does, operate on our minds, and influence at times the determinations of our will, without making us sensible of the restraint to which we are thus subjected; and, in the same manner, no doubt, the suggestions which arise to us in dreams may be produced. The imaginary transactions in which we are then engaged may be such as are actually to occupy us in life; the strange and seemingly incoherent appearances which are presented to the mind's eye in our dreams, may allude to some events which are to befall ourselves or others. It is therefore by no means impossible, or inconsistent with the general analogy of nature, that dreams should have a respect to futurity. We have no reason to regard the dreams related in the Holy Scriptures as not inspired by Heaven, nor to laugh at the idea of a prophetic dream as absurd or ridiculous. At the same time, a mind which, during its waking hours, is filled with anxious thoughts and presentiments of the future, may reproduce these forebodings in its dreams, when the imagination acts over again the scenes of the past day, embellished and diversified with its own peculiar colouring; and as, from the mere law of probabilities, the actual result must sometimes correspond with the anticipative vision, and the dream be realised by the event, the apparent prophetic intimation is thus as much the consequence of natural causes and of the ordinary workings of the mind, as any of the phenomena which it exhibits. To accident alone is to be ascribed that correspondence which, among the uneducated or the unreflecting portion of mankind, passes for divination by means of supernatural agency; and though the cases where it occurs are necessarily few, com-

Dreams. pared with those in which the event falsifies the prognostications of the dreamer, yet being calculated to make a much stronger impression on the mind, they are remembered, whilst the others are forgotten; and hence the exception is, by a natural transition, converted into the rule.

Yet it would be too much to allow to dreams all that importance which has been ascribed to them by the priesthood among heathens, or by the vulgar among ourselves. We know how easily ignorance imposes on itself, and what arts imposture adopts to impose upon others. We cannot trace any certain connection between our dreams and those events to which the simplicity of the vulgar pretends that they refer. And we cannot, therefore, if disposed to confine our belief to certain or probable truths, join with the vulgar in believing them really referrible to futurity.

It appears that the brutes are also capable of dreaming. The dog is often observed to start suddenly up in his sleep, in a manner which cannot be accounted for in any other way than by supposing that he is roused by some impulse received in a dream. The same thing is observable of others of the inferior animals. That they should dream, is not an idea inconsistent with what we know of their economy and manners in general. We may therefore consider it as a pretty certain truth, that many, if not all, of the lower species are liable to dream, as well as human beings.

It appears, then, that in dreaming we are not conscious of being asleep; that to a person dreaming, his dreams seem realities; that although it be uncertain whether mankind are all liable to dream, yet it is well known that they are not all equally liable to dream; that the nature of a person's dreams depends in some measure on his habits of action, and on the circumstances of his life; that the state of the health, too, and the manner in which the vital functions are carried on, have a powerful influence in determining the character of a person's dreams; that in sleep and in dreaming, the senses are either absolutely inactive, or nearly so; that such concerns as we have been very deeply interested in during the preceding day, are very likely to return upon our minds in dreams in the hours of rest; that dreams may be rendered prophetic of future events; that therefore, wherever we have such evidence of their having been prophetic as we would accept on any other occasion, we cannot reasonably reject the fact on account of its absurdity; that, however, they do not appear to have been actually such, in those instances in which the superstition of nations ignorant of true religion has represented them as referring to futurity, nor in those instances in which they are viewed in the same light by the vulgar among ourselves; and, lastly, that dreaming is not a phenomenon peculiar to human nature, but common to mankind with the brutes.

We scarcely know of any other facts that have been fully ascertained concerning dreaming. But we are by no means sufficiently acquainted with this important phenomenon in the history of mind. We cannot tell by what laws of our constitution we are thus liable to be so frequently engaged in imaginary transactions, nor what are the particular means by which the delusion is accomplished. The delusion is indeed remarkably strong. One will sometimes have a book presented to him in a dream, and fancy that he reads; and actually enter into the nature of the imaginary composition before him, and even remember, after he awakes, what he knows that he only fancied himself reading. Can this be delusion? If delusion, how or for what purposes is it produced? The mind, it would appear, does not, in sleep, become inactive like the body, or at least is not always inactive while we are asleep. When we do not dream, the mind must either be inactive, or the connection between the mind and the body

Dreams. must be considered as in some manner suspended; and, when we dream, the mind, though it probably acts in concert with the body, yet does not act in the same manner as when we are awake. It seems to be clouded or bewildered, in consequence of being deprived for a time of the service of the senses. Imagination becomes more active and more capricious; and all the other powers, especially judgment and memory, get disordered and irregular in their operation.

Various theories have been proposed to explain what appears here most inexplicable. Mr Baxter, in his treatise on the immateriality of the human soul, endeavours to prove that dreams are produced by the agency of some spiritual beings, who either amuse or employ themselves seriously in engaging mankind in all those imaginary transactions with which they are employed in dreaming. This theory, however, is far from being plausible. It leads us entirely beyond the limits of our knowledge; it requires us to believe without evidence; it is unsupported by any analogy; and it creates difficulties still more inexplicable than those which it has been proposed to remove. Until it be made to appear that our dreams cannot possibly be produced without the interference of spiritual agents, possessing such influence over our minds as to deceive us with fancied joys, and to involve us in imaginary afflictions, we cannot reasonably refer them to such a cause. Besides, from the facts which have been stated as well known concerning dreams, it appears that their nature depends both on the state of the human body and on that of the mind. But were they owing to the agency of other spiritual beings, how could they be influenced by the state of the body with reference to health or sickness, fasting or repletion? They must be a curious set of spiritual beings who depend in such a manner on the state of our corporeal frame. Better not to allow them existence at all, than to place them in such a dependence.

Wolfius, and after him Formey, have supposed that dreams never arise in the mind, except in consequence of some of the organs of sensation having been previously excited. Either the ear or the eye, or the organs of touching, tasting, or smelling, communicate information in a tacit and secret manner, and thus partly rouse its faculties from the lethargy in which they are buried in sleep, and engage them in a series of confused and imperfect exertions. But what passes in dreams is so very different from all that we do when awake, that it is impossible for the dreamer himself to distinguish whether his powers of sensation perform any part on the occasion. It is not necessary that imagination should be always excited by immediate sensation. Fancy, even when we are awake, often wanders from the present scene. Absence of mind is incident to the studious; the poet and the mathematician many times forget where they are. We cannot discover from any thing that a person in dreaming displays to the observation of others, that his organs of sensation take part in the imaginary transactions in which he is employed. In those instances, indeed, in which persons asleep are said to hear sounds, the sounds which they hear are said also to influence in some manner the nature of their dreams. But such instances are singular. Since then it appears that the person who dreams is himself incapable of distinguishing, either during his dreams, or by recollection when awake, whether any new impressions are communicated to him in that state by his organs of sensation; that even by watching over him, and comparing our observations of his circumstances and emotions in his dreams with what he recollects of them after awaking, we cannot, except in one or two singular instances, ascertain this fact; and that the mind is not wholly incapable of acting while the organs of sensation are at rest, and on many occasions re-

Dreams. fuses to listen to the information which they convey; we may without hesitation conclude that the theory of Wolfius and Formey has been too hastily and incautiously advanced.

Other physiologists tell us that the mind when we dream is in a state of *delirium*. Sleep, they say, is attended with what is called a collapse of the brain; during which either the whole or a part of the nerves of which it consists are in a state in which they cannot carry on the usual intercourse between the mind and the organs of sensation. When the whole of the brain is in this state, we become entirely unconscious of existence, and the mind sinks into inactivity; when only a part of the brain is collapsed, as they term it, we are then neither asleep nor awake, but in a sort of delirium between the two. This theory, like that last mentioned, supposes the mind incapable of acting without the help of sensation; it supposes that we know the nature of a state of which we cannot ascertain the phenomena; and it contradicts a well-known fact, in representing dreams as confused images of things around us, instead of fanciful combinations of things not existing together in nature or in human life. For these reasons it must be held as wholly inadmissible.

Of all the writers who have treated of this subject, however, Mr Dugald Stewart is perhaps the only one who, by concentrating the lights of a sound philosophy on the results of refined and accurate observation, has been enabled to classify the phenomena of dreams, and to introduce the order of science into a department of speculative inquiry where fancy had previously reigned paramount. "Dreams," says Mr Addison, "look like the relaxations and amusements of the soul when she is disencumbered of her machine; her sports and recreations when she has laid her charge asleep. The soul is clogged and retarded in her operations when she acts in conjunction with a companion that is so heavy and unwieldy in its motions; but in dreams she converses with numberless beings of her own creation, and is transported into ten thousand scenes of her own raising. She is herself the theatre, the actor, and the beholder." This description, which is not more beautiful than true, will serve to convey some idea of the difficulties of disentangling mental operations necessarily so complex, and of keeping steadily in view the threefold character or agency which the mind exhibits in dreaming; and as the only approximation which has yet been made towards the accomplishment of so interesting an object is contained in Mr Stewart's section on the application of the principles and laws of association to explain the phenomena of dreaming (*Elements of the Philosophy of the Human Mind*, vol. i. p. 327, sixth edition, Lond. 1818, 8vo), we conceive that we cannot do better than subjoin this exquisite specimen of philosophical acuteness and discrimination, in the author's own beautiful language.

"With respect to the phenomena of dreaming," says Mr Stewart, "three different questions may be proposed. First, what is the state of the *mind* in sleep? or, in other words, what faculties then continue to operate, and what faculties are then suspended? Secondly, how far do our dreams appear to be influenced by our bodily sensations; and in what respects do they vary, according to the different conditions of the body in health and in sickness? Thirdly, what is the change which sleep produces on those parts of the *body* with which our mental operations are more immediately connected; and how does this change operate, in diversifying, so remarkably, the phenomena which our minds then exhibit, from those of which we are conscious in our waking hours? Of these three questions, the first belongs to the philosophy of the human mind; and it is to this question that the following inquiry is almost entirely confined. The second is more particu-

Dreams. larly interesting to the medical inquirer, and does not properly fall under the plan of this work. The third seems to me to relate to a subject which is placed beyond the reach of the human faculties.

"It will be granted, that, if we could ascertain the state of the mind in sleep, so as to be able to resolve the various phenomena of dreaming into a smaller number of general principles; and still more, if we could resolve them into one general fact; we should be advanced a very important step in our inquiries upon this subject; even although we should find it impossible to show in what manner this change in the state of the mind results from the change which sleep produces in the state of the body. Such a step would at least gratify, to a certain extent, that disposition of our nature which prompts us to ascend from particular facts to general laws, and which is the foundation of all our philosophical researches; and, in the present instance, I am inclined to think that it carries us as far as our imperfect faculties enable us to proceed.

"In conducting this inquiry with respect to the state of the mind in sleep, it seems reasonable to expect, that some light may be obtained from an examination of the circumstances which accelerate or retard its approach; for when we are disposed to rest, it is natural to imagine that the state of the mind approaches to its state in sleep more nearly than when we feel ourselves alive and active, and capable of applying all our various faculties to their proper purposes.

"In general, it may be remarked, that the approach of sleep is accelerated by every circumstance which diminishes or suspends the exercise of the mental powers, and is retarded by every thing which has a contrary tendency. When we wish for sleep, we naturally endeavour to withhold, as much as possible, all the active exertions of the mind, by disengaging our attention from every interesting subject of thought. When we are disposed to keep awake, we naturally fix our attention on some subject which is calculated to afford employment to our intellectual powers, or to rouse and exercise the active principles of our nature.

"It is well known that there is a particular class of sounds which compose us to sleep. The hum of bees, the murmur of a fountain, the reading of an uninteresting discourse, have this tendency in a remarkable degree. If we examine this class of sounds, we shall find that it consists wholly of such as are fitted to withdraw the attention of the mind from its own thoughts; and are, at the same time, not sufficiently interesting to engage its attention to themselves.

"It is also matter of common observation, that children, and persons of little reflexion, who are chiefly occupied about sensible objects, and whose mental activity is in a great measure suspended as soon as their perceptive powers are unemployed, find it extremely difficult to continue awake when they are deprived of their usual engagements. The same thing has been remarked of savages, whose time, like that of the lower animals, is almost completely divided between sleep and their bodily exertions.

"From a consideration of these facts, it seems reasonable to conclude, that in sleep those operations of the mind are suspended which depend on our volition; for if it be certain, that before we fall asleep, we must withhold, as much as we are able, the exercise of all our different powers, it is scarcely to be imagined that, as soon as sleep commences, these powers should again begin to be exerted. The more probable conclusion is, that when we are desirous to procure sleep, we bring both mind and body as nearly as we can into that state in which they are to continue after sleep commences. The difference, therefore, between the state of mind when we are inviting sleep, and

Dreams. when we are actually asleep, is this, that in the former case, although its active exertions be suspended, we can renew them if we please. In the other case, the will loses its influence over all our powers both of mind and body, in consequence of some physical alteration in the system, which we shall never probably be able to explain.

"In order to illustrate this conclusion a little farther, it may be proper to remark, that if the suspension of our voluntary operations in sleep be admitted as a fact, there are only two suppositions which can be formed concerning its cause. The one is, that the power of volition is suspended; the other, that the will loses its influence over those faculties of the mind, and those members of the body, which, during our waking hours, are subjected to its authority. If it can be shown then that the former supposition is not agreeable to fact, the truth of the latter seems to follow as a necessary consequence.

"1. That the power of volition is not suspended during sleep, appears from the efforts which we are conscious of making while in that situation. We dream, for example, that we are in danger, and we attempt to call out for assistance. The attempt indeed is in general unsuccessful, and the sounds which we emit are feeble and indistinct; but this only confirms, or rather is a necessary consequence of the supposition that, in sleep, the connexion between the will and our voluntary operations is disturbed or interrupted. The continuance of the power of volition is demonstrated by the effort, however ineffectual.

"In like manner, in the course of an alarming dream, we are sometimes conscious of making an exertion to save ourselves, by flight, from an apprehended danger; but in spite of all our efforts we continue in bed. In such cases we commonly dream that we are attempting to escape, and are prevented by some external obstacle; but the fact seems to be, that the body is at that time not subject to the will. During the disturbed rest which we sometimes have when the body is indisposed, the mind appears to retain some power over it; but as, even in these cases, the motions which are made consist rather of a general agitation of the whole system, than of the regular exertion of a particular member of it, with a view to produce a certain effect, it is reasonable to conclude that, in perfectly sound sleep, the mind, although it retains the power of volition, retains no influence whatever over the bodily organs.

"In that particular condition of the system which is known by the name of *incubus*, we are conscious of a total want of power over the body; and I believe the common opinion is, that it is this want of power which distinguishes the *incubus* from all the other modifications of sleep. But the more probable supposition seems to be, that every species of sleep is accompanied with a suspension of the faculty of voluntary motion; and that the *incubus* has nothing peculiar in it but this, that the uneasy sensations which are produced by the accidental posture of the body, and which we find it impossible to remove by our own efforts, render us distinctly conscious of our incapacity to move. One thing is certain, that the instant of our awaking, and of our recovering the command of our bodily organs, is one and the same.

"2. The same conclusion is confirmed by a different view of the subject. It is probable, as was already observed, that when we are anxious to procure sleep, the state into which we naturally bring the mind approaches to its state after sleep commences. Now it is manifest that the means which nature directs us to employ on such occasions, is not to suspend the power of volition, but to suspend the exertion of those powers whose exercise depends on volition. If it were necessary that volition should be suspended before we fall asleep, it would be impossible for

Dreams. us by our own efforts to hasten the moment of rest. The very supposition of such efforts is absurd, for it implies a continued will to suspend the acts of the will.

"According to the foregoing doctrine with respect to the state of the mind in sleep, the effect which is produced on our mental operations is strikingly analogous to that which is produced on our bodily powers. From the observations which have been already made, it is manifest that in sleep the body is, in a very inconsiderable degree, if at all, subject to our command. The vital and involuntary motions, however, suffer no interruption, but go on as when we are awake, in consequence of the operation of some cause unknown to us. In like manner, it would appear that those operations of the mind which depend on our volition are suspended, while certain other operations are at least occasionally carried on. This analogy naturally suggests the idea that *all* our mental operations which are independent of our will may continue during sleep, and that the phenomena of dreaming may perhaps be produced by these, diversified in their apparent effects, in consequence of the suspension of our voluntary powers.

"If the appearances which the mind exhibits during sleep are found to be explicable on this general principle, it will possess all the evidence which the nature of the subject admits of.

"It was formerly shown that the train of thought in the mind does not depend *immediately* on our will, but is regulated by certain general laws of association. At the same time it appeared, that among the various subjects which thus spontaneously present themselves to our notice, we have the power of singling out any one that we chuse to consider, and of making it a particular object of attention; and that by doing so we not only can stop the train that would otherwise have succeeded, but frequently can divert the current of our thoughts into a new channel. It also appeared that we have a power (which may be much improved by exercise) of recalling past occurrences to the memory by a voluntary effort of recollection.

"The *indirect* influence which the mind thus possesses over the train of its thoughts is so great, that during the whole time we are awake, excepting in those cases in which we fall into what is called a reverie, and suffer our thoughts to follow their natural course, the order of their succession is always regulated more or less by the will. The will, indeed, in regulating the train of thought, can operate only (as I already showed) by availing itself of the established laws of association; but still it has the power of rendering this train very different from what it would have been if these laws had taken place without its interference.

"From these principles, combined with the general fact which I have endeavoured to establish with respect to the state of the mind in sleep, two obvious consequences follow. First, that when we are in this situation, the succession of our thoughts, in so far as it depends on the laws of association, may be carried on by the operation of the same unknown causes by which it is produced while we are awake; and, secondly, that the order of our thoughts in these two states of the mind must be very different; inasmuch as in the one it depends solely on the laws of association; and in the other, on these laws combined with our own voluntary exertions.

"In order to ascertain how far these conclusions are agreeable to truth, it is necessary to compare them with the known phenomena of dreaming; for which purpose I shall endeavour to show, first, that the succession of our thoughts in sleep is regulated by the same general laws of association to which it is subjected while we are awake; and, secondly, that the circumstances which discriminate

Dreams. dreaming from our waking thoughts are such as must necessarily arise from the suspension of the influence of the will.

"I. That the succession of our thoughts in sleep is regulated by the same general laws of association which influence the mind while we are awake, appears from the following considerations.

"1. Our dreams are frequently suggested to us by bodily sensations; and with these it is well known, from what we experience while awake, that particular ideas are frequently very strongly associated. I have been told by a friend, that having occasion, in consequence of an indisposition, to apply a bottle of hot water to his feet when he went to bed, he dreamed that he was making a journey to the top of Mount *Ætna*, and that he found the heat of the ground almost insupportable. Another person, having a blister applied to his head, dreamed that he was scalped by a party of Indians. I believe every one who is in the habit of dreaming will recollect instances, in his own case, of a similar nature.

"2. Our dreams are influenced by the prevailing temper of the mind, and vary in their complexion according as our habitual disposition at the time inclines us to cheerfulness or to melancholy. Not that this observation holds without exception; but it holds so generally, as must convince us that the state of our spirits has some effect on our dreams as well as on our waking thoughts. Indeed, in the latter case, no less than in the former, this effect may be counteracted or modified by various other circumstances.

"After having made a narrow escape from any alarming danger, we are apt to awake in the course of our sleep with startings, imagining that we are drowning, or on the brink of a precipice. A severe misfortune, which has affected the mind deeply, influences our dreams in a similar way, and suggests to us a variety of adventures analogous in some measure to that event from which our distress arises. Such, according to Virgil, were the dreams of the forsaken Dido.

"3. Our dreams are influenced by our prevailing habits of association while awake.

"In a former part of this work I considered the extent of that power which the mind may acquire over the train of its thoughts; and I observed that those intellectual diversities among men, which we commonly refer to peculiarities of genius, are at least in a great measure resolvable into differences in their habits of association. One man possesses a rich and beautiful fancy, which is at all times obedient to his will. Another possesses a quickness of recollection, which enables him at a moment's warning to bring together all the results of his past experience, and of his past reflections, which can be of use for illustrating any proposed subject. A third can without effort collect his attention to the most abstract questions in philosophy; can perceive at a glance the shortest and the most effectual process for arriving at the truth; and can banish from his mind every extraneous idea which fancy or casual association may suggest to distract his thoughts or to mislead his judgment. A fourth unites all these powers in a capacity of perceiving truth with an almost intuitive rapidity, and in an eloquence which enables him to command at pleasure whatever his memory and fancy can supply to illustrate and to adorn it. The occasional exercise which such men make of their powers may undoubtedly be said, in one sense, to be unpremeditated or unstudied; but they all indicate previous *habits* of meditation or study, as unquestionably as the dexterity of the expert accountant, or the rapid execution of the professional musician.

"From what has been said, it is evident that a train of

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"The influence of the same habits may be traced distinctly in sleep. There are probably few mathematicians who have not dreamed of an interesting problem, and who have not even fancied that they were prosecuting the investigation of it with much success. They whose ambition leads them to the study of eloquence are frequently conscious, during sleep, of a renewal of their daily occupations; and sometimes feel themselves possessed of a fluency of speech which they never experienced before. The poet in his dreams is transported into Elysium, and leaves the vulgar and unsatisfactory enjoyments of humanity, to dwell in those regions of enchantment and rapture which have been created by the divine imaginations of Virgil and of Tasso.

"As a farther proof that the succession of our thoughts in dreaming is influenced by our prevailing habits of association, it may be remarked, that the scenes and occurrences which most frequently present themselves to the mind while we are asleep are the scenes and occurrences of childhood and early youth. The facility of association is then much greater than in more advanced years; and although during the day the memory of the events thus associated may be banished by the objects and pursuits which press upon our senses, it retains a more permanent hold of the mind than any of our subsequent acquisitions; and, like the knowledge which we possess of our mother tongue, is, as it were, interwoven and incorporated with all its most essential habits. Accordingly, in old men, whose thoughts are in a great measure disengaged from the world, the transactions of their middle age, which once seemed so important, are often obliterated; while the mind dwells, as in a dream, on the sports and the companions of their infancy.

"I shall only observe farther, on this head, that in our dreams, as well as when awake, we occasionally make use of words as an instrument of thought. Such dreams, however, do not affect the mind with such emotions of pleasure and of pain, as those in which the imagination is occupied with particular objects of sense. The effect of philosophical studies, in habituating the mind to the almost constant employment of this instrument, and, of consequence, its effect in weakening the imagination, was formerly remarked. If I am not mistaken, the influence of these circumstances may also be traced in the history of our dreams, which in youth commonly involve in a much greater degree the exercise of imagination, and affect the mind with much more powerful emotions, than when we begin to employ our maturer faculties in more general and abstract speculations.

"II. From these different observations we are authorized to conclude, that the same laws of association which regulate the train of our thoughts while we are awake, continue to operate during sleep. I now proceed to consider how far the circumstances which discriminate dreaming from our waking thoughts, correspond with those which might be expected to result from the suspension of the influence of the will.

"1. If the influence of the will be suspended during sleep, all our voluntary operations, such as recollection, reasoning, &c. must also be suspended.

"That this really is the case, the extravagance and inconsistency of our dreams are sufficient proofs. We frequently confound together times and places the most re-

mote from each other; and, in the course of the same dream, conceive the same person as existing in different parts of the world. Sometimes we imagine ourselves conversing with a dead friend, without remembering the circumstance of his death, although perhaps it happened but a few days before, and affected us deeply. All this proves clearly that the subjects which then occupy our thoughts are such as present themselves to the mind spontaneously, and that we have no power of employing our reason in comparing together the different parts of our dreams, or even of exerting an act of recollection, in order to ascertain how far they are consistent and possible.

"The processes of reasoning in which we sometimes fancy ourselves to be engaged during sleep, furnish no exception to the foregoing observation; for although every process, the first time we form it, implies volition, and, in particular, implies a recollection of the premises till we arrive at the conclusion, yet when a number of truths have been often presented to us as necessarily connected with each other, this series may afterwards pass through the mind according to the laws of association, without any more activity on our part than in those trains of thought which are the most loose and incoherent. Nor is this mere theory. I may venture to appeal to the consciousness of every man accustomed to dream, whether his reasonings during sleep do not seem to be carried on without any exertion of his will, and with a degree of facility of which he was never conscious while awake. Mr Addison, in one of his Spectators, has made this observation; and his testimony, in the present instance, is of the greater weight, that he had no particular theory on the subject to support. 'There is not,' says he, 'a more painful action of the mind than invention, yet in dreams it works with that ease and activity that we are not sensible when the faculty is employed. For instance, I believe every one, some time or other, dreams that he is reading papers, books, or letters; in which case the invention prompts so readily, that the mind is imposed on, and mistakes its own suggestions for the composition of another.' No. 487.

"2. If the influence of the will during sleep be suspended, the mind will remain as passive, while its thoughts change from one subject to another, as it does during our waking hours, while different perceptible objects are presented to our senses.

"Of this passive state of the mind in our dreams it is unnecessary to multiply proofs, as it has always been considered as one of the most extraordinary circumstances with which they are accompanied. If our dreams as well as our waking thoughts were subject to the will, is it not natural to conclude, that in the one case, as well as in the other, we would endeavour to banish, as much as we could, every idea which had a tendency to disturb us, and detain those only which we found to be agreeable? So far, however, is this power over our thoughts from being exercised, that we are frequently oppressed, in spite of all our efforts to the contrary, with dreams which affect us with the most painful emotions. And, indeed, it is matter of vulgar remark, that our dreams are, in every case, involuntary on our part, and that they appear to be obtruded on us by some external cause. This fact appeared so unaccountable to the late Mr Baxter, that it gave rise to his very whimsical theory, in which he ascribes dreams to the immediate influence of separate spirits on the mind.

"3. If the influence of the will be suspended during sleep, the *conceptions* which we then form of sensible objects will be attended with a belief of their real existence, as much as the *perception* of the same objects is while we are awake.

"In treating of the power of Conception, I formerly observed, that our belief of the separate and independent

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existence of the objects of our perceptions, is the result of experience; which teaches us, that these perceptions do not depend on our will. If I open my eyes, I cannot prevent myself from seeing the prospect before me. The case is different with respect to our conceptions. While they occupy the mind, to the exclusion of every thing else, I endeavoured to shew that they are always accompanied with belief; but as we can banish them from the mind, during our waking hours, at pleasure, and as the momentary belief which they produce is continually checked by the surrounding objects of our perceptions, we learn to consider them as fictions of our own creation, and, excepting in some accidental cases, pay no regard to them in the conduct of life. If the doctrine, however, formerly stated with respect to conception be just, and if, at the same time, it be allowed that sleep suspends the influence of the will over the train of our thoughts, we should naturally be led to expect, that the same belief which accompanies perception while we are awake, should accompany the conceptions which occur to us in our dreams. It is scarcely necessary for me to remark, how strikingly this conclusion coincides with acknowledged facts.

"May it not be considered as some confirmation of the foregoing doctrine, that when opium fails in producing complete sleep, it commonly produces *one* of the effects of sleep, by suspending the activity of the mind, and throwing it into a reverie; and that while we are in this state, our conceptions frequently affect us nearly in the same manner as if the objects conceived were present to our senses?

"Another circumstance with respect to our conceptions during sleep deserves our notice. As the subjects which we then think upon occupy the mind exclusively, and as the attention is not diverted by the objects of our external senses, our conceptions must be proportionably lively and steady. Every person knows how faint the conception is which we form of any thing with our eyes open, in comparison of what we can form with our eyes shut; and that in proportion as we can suspend the exercise of all our other senses, the liveliness of our conception increases. To this cause is to be ascribed, in part, the effect which the dread of spirits in the dark has on some persons who are fully convinced in speculation that their apprehensions are groundless; and to this also is owing the effect of any accidental perception in giving them a momentary relief from their terrors. Hence the remedy which nature points out to us when we find ourselves overpowered by imagination. If every thing around us be silent, we endeavour to create a noise by speaking aloud or beating with our feet; that is, we strive to divert the attention from the subjects of our imagination by presenting an object to our powers of perception. The conclusion which I draw from these observations is, that as there is no state of the body in which our perceptive powers are so totally unemployed as in sleep, it is natural to think that the objects which we conceive or imagine must then make an impression on the mind beyond comparison greater than any thing of which we can have experience while awake.

"From these principles may be derived a simple, and, I think, a satisfactory explanation of what some writers have represented as the most mysterious of all the circumstances connected with dreaming; the inaccurate estimates we are apt to form of time while we are thus employed—an inaccuracy which sometimes extends so far as to give to a single instant the appearance of hours, or perhaps of days. A sudden noise, for example, suggests a dream connected with that perception; and the moment afterwards this

noise has the effect of awaking us; and yet during that momentary interval a long series of circumstances has passed before the imagination. The story quoted by Mr Addison (*Spectator*, No. 94) from the Turkish Tales, of the miracle wrought by a Mahometan doctor to convince an infidel sultan, is in such cases nearly verified.

"The facts I allude to at present are generally explained by supposing that, in our dreams, the rapidity of thought is greater than while we are awake; but there is no necessity for having recourse to such a supposition. The rapidity of thought is at all times such, that in the twinkling of an eye, a crowd of ideas may pass before us to which it would require a long discourse to give utterance; and transactions may be conceived which it would require days to realize. But in sleep the conceptions of the mind are mistaken for realities; and therefore our estimates of time will be formed, not according to our experience of the rapidity of thought, but according to our experience of the time requisite for realizing what we conceive. Something perfectly analogous to this may be remarked in the perceptions we obtain by the sense of sight. When I look into a show-box, where the deception is imperfect, I see only a set of paltry daubings of a few inches diameter; but if the representation be executed with so much skill as to convey to me the idea of a distant prospect, every object before me swells in its dimensions, in proportion to the extent of space which I conceive it to occupy; and what seemed before to be shut up within the limits of a small wooden frame, is magnified, in my apprehension, to an immense landscape of woods, rivers, and mountains.

"The phenomena which we have hitherto explained take place when sleep seems to be complete; that is, when the mind loses its influence over *all* those powers whose exercise depends on its will. There are, however, many cases in which sleep seems to be partial; that is, when the mind loses its influence over *some* powers, and retains it over others. In the case of the *somnambuli*, it retains its power over the limbs, but it possesses no influence over its own thoughts, and scarcely any over the body, excepting those particular members of it which are employed in walking. In madness, the power of the will over the body remains undiminished, while its influence in regulating the train of thought is in a great measure suspended, either in consequence of a particular idea, which engrosses the attention, to the exclusion of every thing else, and which we find it impossible to banish by our efforts, or in consequence of our thoughts succeeding each other with such rapidity that we are unable to stop the train. In both of these kinds of madness, it is worthy of remark, that the conceptions or imaginations of the mind becoming independent of our will, they are apt to be mistaken for actual perceptions, and to affect us in the same manner."

Some very beautiful fables have been written both by ancients and moderns in the form of dreams. The *Somnium Scipionis*, for instance, is perhaps one of the finest of Cicero's compositions. He who shall carefully peruse this piece, with Macrobius's commentary thereupon, will undoubtedly acquire a considerable knowledge of ancient philosophy. In the periodical publications which early diffused so much elegant and useful knowledge throughout Britain, the *Tatlers*, *Spectators*, *Guardians*, and the like, we find a number of excellent dreams. Addison excelled in this line of writing; his *Vision of Mirza* is a masterpiece of its kind. But the public are now less partial to this species of composition than they formerly were: writings purely imaginative, having ceased to be relished, are no longer produced.

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DREDGING,

Dredging. Is a term used to express the important operation in the practice of the engineer, of removing deposited matters from the beds of navigable rivers, harbours, canals, and basins.

The process of silting. In describing the several methods by which dredging has been successfully employed, it is not our intention to enter into geological discussions regarding the ultimate tendency of the process of deposition; but we cannot allow it to pass without at least hinting at its original cause, a knowledge of which may lead the inexperienced practitioner more readily to the proper means of removing an evil so generally complained of in our most secure and sheltered harbours. If the universal tendency to waste and decay in the higher lands, from the agency of moisture, heat, and frost, be considered, we shall find that every rill of water must carry along with it a portion of separated matter. These rivulets being so many tributary streams to the great rivers which form the drainage of vast tracts of country, we need not be surprised to find that the beds and embouchures of the Scheldt, the Meuse, the Rhine, and the Elbe, or of the Thames, the Humber, the Tay, and other great tributaries to the German Ocean, should be variously silted up; and that even this great basin itself should be much encumbered by numerous banks of deposited matters. To the agency of these, combined with the effects of cross-running tides, we ascribe the existence of the Dogger Banks, the Yarmouth Sands, the Flemish Banks, and even the great platforms of Holland, and the opposite planes of the Fens of Lincoln.

There is also a marked difference to be noticed in the separation and distribution of these matters of deposition. In those rivers which flow with a very gentle current toward the sea, fine silt, or what is sometimes termed ouse, is produced; while rivers of greater fall, and consequently of more velocity, carry forward the grosser particles proportionally farther from their embouchures. Another circumstance which deserves our notice is the greater specific gravity of salt water than fresh, which (as has been ascertained by the writer of this article, on the Dee at Aberdeen, and other rivers where he has made observations) preserve their course in distinct films, the salt water under the fresh. The salt water thus flows up the courses of the respective rivers to an extent corresponding to the fall of their beds and the rise of the tide. A considerable portion of the heavier matters, as gravel and sand, are arrested in their progress sea-ward, where the current is languid; while the lighter particles floating at or near the surface are either borne along with the stream into the expanse of the ocean, or settle in the eddy-waters. In this way the projecting obstacles along the margin are formed, and thus accumulate in the form of sand banks and small islets; the creeks and sinuosities are also silted up, and too often render the connecting harbours and shipping places so shallow, as to be unfit for the purposes of floating ships of burden. To such a degree has this been experienced in some situations, as, for example, Sandwich in Kent, that this ancient sea-port is left almost in the state of an *inland town*; while other ports have been more or less deteriorated. Importance is therefore justly attached to such means as may be instrumental in counteracting or preventing the tendency of this process of silting. We shall accordingly direct the attention of our readers to some of those means, both natural and artificial.

Where recourse can be had to natural means in keeping a navigable channel clear, they will always be found preferable to those which are artificial. The great agent laid to our hand by nature for this purpose is the judicious use and application of the drainage waters of the connecting district, and the preservation of the full and ample flow of the tide waters. But in many instances these means are tampered with, and rendered ineffectual, by the reckless thirst of acquiring land at the expense or by the exclusion of the back-waters arising from the flow of the tide. Notwithstanding all that can be said by professional men upon the subject, this practice prevails in many parts of the united kingdom to a frightful extent. With a view to put a stop to this, an act (in which the late eminent engineer Mr Rennie, and the writer of this article, had some connection) which originated with the admiralty, was passed in 1806, entitled "An act for the preservation of public harbours of the united kingdom," Geo. III. cap. 153. But this act wants amendment, and has been rarely acted upon, especially to the extent contemplated by Earl Grey, then Lord Harwich, and first lord of the admiralty.

In noticing the natural means of cleaning harbours, we cannot perhaps better illustrate the subject than by referring to Montrose, in Forfarshire, where some of the continuous proprietors have from time to time proposed to make firm ground of part of the great natural basin connected with the harbour of that port. This basin is flooded every tide to the extent of about five square miles, and is estimated, especially in spring-tides, to contain about fifty-five millions of cubic yards of the back-waters of the tide, which passing four times in the twenty-four hours through this harbour, produces so powerful a current that the shifting sand-bank at the entrance, called the Annet, is prevented from being thrown across the mouth of it in gales of easterly wind. In this state of the weather the Annet-bank has a continual tendency westward, while the back-waters of this great natural basin check its progress, and not only keep the navigation open, but are sufficient to preserve a considerable depth in it during the lowest tides.

In the course of forming the bold design of opening a Lake Lo-harbour near Lowestoffe, and carrying an inland navigation to the mercantile city of Norwich, Mr Cubit the engineer projected an entrance to this harbour, with a pair of gates measuring fifty feet in width, and of a depth so considerable that their ground-sill is sunk about twelve feet under low water of spring-tides, the rise of which upon this coast is very limited: the gates are laid at this depth, so as to be capable of receiving the largest class of mercantile ships. They are also ingeniously contrived for letting off the head-waters of Lake Lothing. This extensive sheet of water, which pervades a great portion of the lower district of Suffolk, is to be used as back-water to scour and keep the entrance of the harbour open against the effects of storms from the east sea acting upon the sand banks which so much encumber this part of the coast. This great work is only in the progress of being executed, but very sanguine expectations are entertained of its success.

In the improvement of the navigation of the river Clyde, the means resorted to have been those of narrowing the channel and confining the current; and these have been so successful that a depth of about ten feet has been obtained, instead of only five feet as formerly, by which the trade

Dredging. and commerce of the city of Glasgow derive the most decided advantages. Formerly only barges came up to the city, now sea-borne ships from all quarters of the globe are seen at its quays. But in forming a design upon the principle of narrowing the channel of a river, and thereby shutting out a portion of the tide waters, several elements connected with the local circumstances of the place require to be carefully weighed before attempting to lessen the capacity or water-way of a river. Much depends on the level or rise of the bed of the river, the perpendicular rise of the tide on the coast, the situation of its embouchure, and other circumstances which favourably and fortunately present themselves upon the Clyde. The application of the steam tug-boat, in towing vessels through narrow channels, has removed objections of the most serious nature upon this navigation.

Ballyshannon-harbour. Many other circumstances might be adduced to show the advantages of supplying the natural means in our power to the scouring of navigable tracks. The writer of this article has now (1833) under consideration the improvement of the harbour of Ballyshannon, in the county of Donegal, which possesses the natural means to an immense extent of clearing its embouchure, having almost the entire drainage waters of the county of Fermanagh collected in Lough Erne, which extend to about fifty miles in length, and in some places three miles in breadth, the entire overflow of which passes over the bar of Ballyshannon harbour.

Artificial means of dredging. The most eminent engineers, both of our own country and of France, have introduced scouring basins into their designs of tide harbours. Mr Smeaton constructed a tide-basin of this kind at Ramsgate in Kent, where the silt of the outer harbour is loosened by artificial means, and dredged into the tracks or courses of water issuing from the sluices of an artificial tide-basin. By this means a considerable portion of the deposited stuff is carried out of the harbour into deep water. It is, however, to be regretted that there is not a more extensive collection of back-waters here, as, from its very circumscribed position, that eminent engineer was prevented from enlarging his scouring basin to a sufficient extent to ensure the best effects of his design.

Dover. At Dover there is a good example of artificial scouring upon a small scale. This harbour is often choked up in a single tide, with the debris of the heights of Dover, and with the flinty gravel which surrounds this coast. Upon these occasions, the back-waters of an adjoining basin are conducted in great cast-iron pipes of about three feet in diameter. The water issuing from these pipes is made to act upon a system of temporary weirs, consisting of deal-boards set on edge, which are shifted about at pleasure in different directions, so as to bring the water from the sluices to bear upon the gravel; and it is astonishing with what facility the entrance to this harbour is by these means cleaned and rendered accessible to the packets, from a state of being quite shut up.

Liverpool docks. In extensive plans of docks for floating ships much use is or may be made of a system of soughs or sluices for scouring or floating away mud. By opening these sluices from one dock into another, as is done by Mr Hartley, engineer for the Liverpool docks, the advantages of such a command of *head-water* is attended with the most beneficial effects, both for clearing the several docks, and also the outer harbours or receiving basins of this great port.

Dredging implements, &c. The common plough and harrow, differing very little from their ordinary construction, and also a kind of frame of timber shod with plate iron, and provided with stilts or handles somewhat like a great shovel, are often used for loosening and dredging stuff within reach of removal by a stream of back-water, with which it is afterwards floated out of the respective harbours or navigable tracks. These

and various other simple implements, suited to local circumstances, are sometimes employed by manual labour, and also with horse power, where the bottom is sufficiently firm to admit of the necessary trackage. Nor must we omit to mention the use of the common wheelbarrow and spade so much used in operations of this kind.

The spoon dredging apparatus, with its boat, as represented in Plate CCV., fig. 13, is of long standing, and was probably first used by the Dutch, who still apply it extensively. It is also much employed upon the river Thames, for lifting ballast and deepening the navigation of that greatest of all commercial rivers. Referring to fig. 13, the reader will at once comprehend the construction and application of this simple apparatus. The boats for this purpose vary in size according to the situation in which they are to be worked, say from twenty to sixty tons burden. They are built to float upon an easy draught of water, and are sometimes flush-decked, carrying their cargo wholly upon deck; but for the greater part, and especially those of the larger size, they are in the state of open boats, with a kind of inner sole or floor. When the excavated matters are not to be employed in banking on the sides of the river, or ballasting ships, the boat is formed with a kind of hopper-hold, somewhat upon the principle of the fishing smacks, with wells, being convenient for getting quit of the stuff in deep water. In this case a hold of two compartments, one fore and one aft, are formed, as represented by the dark shading and dotted lines in fig. 13. Each of these hoppers has an aperture or opening in the bottom, through which the stuff is dropped by the flap-door, marked letter A, as represented in the figure. In some circumstances, also, the stuff is received into a system of sheet-iron boxes, and lifted out of the boat by a tackle, to be emptied. The spoon or shovel, marked letter B, which accompanies these boats, consists of a strong ring or hoop of malleable iron, the cutting part of which is of steel, and is about six or seven feet in circumference, properly formed for dredging upon soft mud or gravelly ground. To this ring a large bag made of bullocks' hide, but more generally of tanned leather, is strongly attached with thongs. The bag is perforated with a number of small holes for allowing the water to drain off, and its capacity may be about four or five cubic feet. A pole of from thirty to forty feet in length is fixed to the spoon, or rather two poles are so laid together with hoops and rings as to be lengthened or shortened at pleasure, to suit the depth of water in which the apparatus is required to work. A rope is also attached to the bottom of the bag, for directing its position at the commencement of each operation. This apparatus is generally worked with a chain or rope, brought from the spoon to a winch, worked with wheel and pinion, through a block suspended from a small crane used for hauling the bag and its contents along with the progress of the boat, and in lifting the spoon over the gunwale to be emptied into the hopper of the boat. The purchase-rope is led along the deck to the winch, by a snatch-block placed in a proper direction for this purpose. The boat is moored at the head and stern, and its berth may be shifted at pleasure. These boats are generally managed and worked with from two to four men, who with this simple apparatus can lift in a tide from twenty to sixty tons of stuff from the bottom, at the depth of two and a half or three fathoms, when the ground is somewhat loose, and favourable for the operation. In Holland this apparatus, and all these simple modes of dredging, are much practised upon the extensive flats at the entrance of their great navigable rivers, in connection with the sluices and natural currents issuing from their extensive basins and canals. On the British coast, dredging, when carried on to any extent,

Dredging. is now confined chiefly to the spoon and bucket machines; and here steam, wherever it can be applied, is the great moving power. In Holland the excavated matter is very generally of a mossy description, which, after being strongly compressed in moulds by that industrious people, is in a state to be speedily used as turf fuel. On the Thames the spoon dredging machine is conducted upon a large scale, and in the most systematic manner, under the immediate direction of the Trinity Board. The stuff brought from the bottom consists chiefly of mud and gravel. This is not only a useful operation for deepening and preserving the navigation, but the stuff itself is sold to good advantage as ballast for shipping. To such an extent is this carried, that the colliers, or shipping from London to Newcastle, have raised ballast hills in the neighbourhood of Shields, which from their vast extent have become objects of no small curiosity.

Bucket dredging machine.

In proportion as the commerce of a country extends, its ships increase in their dimensions, and a greater depth of water is consequently required to float them; and hence greater difficulty and expense attends the construction and preservation of harbours for their accommodation. To effect these objects, and especially to obtain a greater depth of water, recourse has been had to various means, such as the extension of piers, the formation of breakwaters, and deepening by means of the process of dredging now described. These simple modes have, however, been succeeded by a still more powerful engine termed the bucket dredging machine.

Since the date of the last edition of this work, very considerable improvements have been effected in the system of dredging, both by the application of the power of steam, and the form and construction of the apparatus itself, as well as that of the vessel containing it. The machine is said to have been first worked by men only: when the principles upon which it acts were more fully ascertained, horses were employed, and worked round a covered gin-track or circular path within the boat. A machine of this description, worked by horse power, was used for some years at the port of Greenock, though it was there ultimately found more suitable and expedient to resort to manual labour, applied by crane-work with wheel and pinion. Perhaps, in all situations where fuel is very expensive, and where the work is not of sufficient extent for the full employment of steam, it will be found better, in a process of this kind, to employ manual labour than horses, which, from the circumscribed and hampered nature of the track on board of the vessel, must be very disadvantageous, as experience has shown on the Clyde. Indeed, the only question seems to be, in such cases where steam cannot be profitably employed, whether it were not better to use the spoon apparatus, as upon the Thames, where manual labour is at the highest rate.

In this article we shall give a minute detail of one of the best and latest constructed dredging machines, employed by Messrs Gibb upon the harbour works of Aberdeen. This machine was entirely constructed by Messrs John Duffus and Company of that port, both as regards the vessel and the machinery. In describing it we refer to Plates CCIV. and CCV. Fig. 1, Plate CCIV., represents a longitudinal section of the vessel, exposing to view an elevation of the steam-engine and bucket apparatus, with its framework. The ground to be dredged is also shown, with the buckets in contact, and the attendant barge astern. Fig. 2 is a plan of the vessel and machinery. Her extreme length as taken by measurement is ninety feet, and the extreme breadth twenty-two feet; the length of the ark or well which contains the bucket-frame is fifty-four feet, and its width four feet one inch in the clear. The after-part of the vessel being thus formed into two compartments, these

are connected at the stern by four strong timbers, placed across the well, and immediately above the keel. Upon these, timbers are placed in sloping directions for supporting the planking. This vessel draws only four feet of water, but the bucket frame can be lowered so as to dredge in a depth of fifteen feet. The steam engine is of the usual form of marine condensing engines; the diameter of the cylinder is twenty-four inches, and the length of the stroke thirty-one inches, being equal to the power of about sixteen horses. From the nature of the process of dredging, the resistance is extremely irregular, causing violent shocks; and therefore malleable instead of cast iron is used as much as possible in the construction of the moving parts. For the same reason a heavy fly-wheel becomes necessary, to regulate the motion. As a vessel of this description, in a tide harbour, must frequently get aground in places where it is unequal, the whole machinery is liable to be strained. On this account it is necessary that all pipes connected with the engine should be of copper, and for the same reason every facility is given for disengaging the parts of the machinery, to prevent fracture or derangement. From the corrosive nature of the stagnant water in harbours, which must be used for condensing, it is necessary to line or case the air-pump with copper or brass, and also to make the buckets, air-pump, valves, and rod, of the same metal. It has been observed that cast iron wastes more rapidly when exposed to the action of this harbour-water than in the open sea.

Subjoined are the dimensions of some of the principal parts of the engine. These, to the practical engineer, may hardly seem to be necessary; but as the Aberdeen machine has been found to answer every expectation, and as it appears to the writer to be similar to those so successfully employed on the river Clyde, it may be of consequence to the general reader to know, from such data, the proper strength and size for its different parts. This engine is set upon a cast-iron cistern, measuring three feet in width, and prolonged as far as to contain the air-pump, foot-valve, and condenser. The cistern and cylinder, set on the top, are strongly bolted down through the bottom of the vessel. On the top of the cistern the columns of support for the fly-wheel shaft are set at a sufficient height to connect with the dredge-gearing, which is stayed by a circular entablature, as represented in the plan of the engine at letter *a*. It has also a diagonal stay, securely bolted to a bracket, cast on the side of the cylinder. The side levers of the engine are seven feet eight and a fourth inches long; between centres one and three-fourth inches thick of plate, and three and three-fourth inches thick on the back; fifteen inches broad in the middle, with forked ends one and three-fourth inches thick, for laying hold of the cross-rail and cylinder side-rods. The cylinder cross-head is seven and a half inches deep at the middle, tapering to four inches where the side-rods are attached, and five and a fourth inches in diameter at the eye, and two inches in thickness. The cross-head of the air-pump is four and a half inches diameter at the eye, five and a half inches deep, and one and three-fourth inches thick. The cylinder side-rods are two and one-eighth inches diameter at each end, and two and two-eighth inches at the middle. The side-rods of the air-pump are finished with forked ends, for embracing the side-lever centre on each side, and fitted with straps and braces. The main centres are four and five-eighth inches diameter, keyed into the side levers. The parallel motion is constructed with radius and parallel boxes, as is usual in this description of engine. The connecting-rod is of malleable iron, three inches diameter at both ends, and three and three-fourth inches at the centre, fitted into the eye of the cross-tail with a gib and cutter. The fly-wheel

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Dredging. is ten feet three inches in diameter, and eight inches deep by four inches broad in the rim, as represented in dotted lines upon the cross section of the vessel, fig. 3, Plate CCV., and at fig. 1, Plate CCIV. The shaft is of cast iron, seven and three-fourth inches diameter. The engine is also provided with a governor and its necessary connections, and is driven from the fly-wheel shaft by means of a pulley and belt.

The boiler, marked *c*, fig. 1, Plate CCIV., is of iron, measuring ten feet four inches across the end, eight feet four inches long, and four feet eight inches in height in the middle, with two furnaces two feet three inches wide. The water-ways between the flues are four inches wide, and the flues fifteen and a half inches, making one and a half turns in the length of the boiler. The sides and tops of the furnaces, the bottoms and sides of the flues, are three eighths of an inch thick, and the top half an inch in thickness. The copper steam-pipes are of the thickness No. 10 on the wire-gauge, the funnel *a* of the engine is two feet in diameter and twenty-five feet in height, made of plate-iron an eighth of an inch in thickness.

Fig. 3, Plate CCV., represents a cross section of the vessel accurately drawn to the scale, showing its outline, and the manner in which it is constructed. The machinery is supported upon the three keels ABC of the vessel by their respective keelsons, or beams placed immediately over them. The bottom of the vessel is further supported by the like means, DD. The central keel extends only to the fore part of the ark or well. This cross section also exhibits an elevation of the train of wheels for raising and lowering the bucket-frame. From the main spur-wheel on the lying shaft, marked E, fig. 3, Plate CCV., down to the lowest wheel on the same shaft, with the chain-barrel, marked L, the connection is in the following order. The main spur-wheel is of that description called a mortise-wheel: it is eight feet in diameter, constructed in a very ingenious manner, to revolve upon a friction nave as follows: The nave is three feet seven inches in diameter, smoothly turned on the circumference, and fixed to the lying shaft with keys. The wheel is also particularly turned in the eye to coincide with the nave, and is furnished with eight pincing plates and screws marked *f*, for tightening it at pleasure, and made to pass with sufficient force upon the nave, in order to carry the spur-wheel round in its fair work along with it; but if overstrained, it immediately slips, and thereby any injurious consequences to the apparatus are prevented. The cogs or teeth of this wheel are made of hard wood; all the teeth of the other wheels are made of cast iron. The spur-pinion *g*, the half of which only is shown, is on the same shaft with the fly, as is also the small spur-wheel *h*. The pinion *g* works in the main spur-wheel, and is three feet six inches in diameter. The small spur-wheel *h*, the half of which only is shown, connects the engine and the other wheels for working the chain-barrel: it is three feet seven and a half inches in diameter, and works in the wheel *i*, measuring four feet two and three fourth inches in diameter. On the shaft of the last-mentioned wheel, which is four and an eighth inches square, there is fixed a pinion *j*, of one foot three inches diameter, working in the wheel K, which is three feet eleven inches in diameter; and on the same shaft there is fixed a wheel *l*, two feet six inches in diameter, working in another wheel L, which is four feet ten inches in diameter: it is fixed upon the shaft that carries the purchase chain-barrel, and is the last wheel of the train. The barrel of cast iron, Plate CCIV., fig. 1 and 2, measures five feet ten inches in length within the flanges, two feet in diameter, and two feet eight inches over the flanges. It makes six and one tenth revolutions in one minute, being equal to thirty-eight strokes of the piston.

This barrel is provided with an offset-clutch, for engaging and disengaging it from the engine, for the purpose of raising and lowering the bucket-frame; and as a precaution against accident, this clutch is provided with a friction-nave similar to that already described for the main spur-wheel. This becomes indispensably necessary in situations like that of Aberdeen, where tree-roots, stones, or the like, obstruct the buckets. The machinery would otherwise run great risk of being torn in pieces and destroyed. This barrel is also provided with a brake-wheel and friction-hoop, for lowering or fixing the bucket-frame to any required depth. This is effected by means of a weight constantly acting over a pulley at the extremity of the lever *s*, Plate CCIV. fig. 1, for pressing the friction-hoop upon the circumference of the brake-wheel with force sufficient to hold the bucket-frame in any position. But when this weight is partially removed, which is done by the hand, the bucket-frame is lowered to the intended depth at the discretion of the master of the vessel, or person who has charge of the work. The upper tumbler is square, as shown in fig. 1, Plate CCV. and in the vertical section, fig. 2, showing the flange and part of the body of the tumbler. In the original form it is cast in one piece, the body being an octagonal prism, and is afterwards brought to the square form by bolting the triangular bars *a* on the alternate sides. Fig. 12 represents the upper end of the bucket-frame, the shaft M which carries the tumbler N, and the great bevelled-wheel O, which is shown in section; also a view of one of the buckets P attached to the links QQ of the bucket-chain. RR are the plumber-blocks, and SS the brackets for supporting the shaft. Fig. 4 is a cross section of the under tumbler of the bucket-frame, which is five sided: *a* is the flange, *b* the strong studs to which the tumbler bars are bolted, *c* the tumbler bars, and *d* the bolts by which they are secured. Fig. 5 is a vertical section of the flange, with the same letters of reference, showing the method of fixing the tumbler bars. The lying shaft is of cast iron, in five lengths, as represented in the longitudinal section, Plate CCIV. fig. 1. It is six and a half inches in diameter; the second length of the shaft is furnished with an offset clutch at *m*, for disengaging the bucket-frame without stopping the engine. This clutch is put into and out of gear by the lever *n*; but the clutch is more particularly shown in Plate CCV. fig. 6 and 7. The coupling-boxes for the lying shaft are fifteen inches long by one and three fourth inches thick, fastened together by four screwed bolts of one and a fourth inch square.

The bucket-frame, with its train of buckets, as represented in Plate CCIV. fig. 1, is fifty-two feet in length between the centres of the lower and upper tumbler shafts. The frame is of the best oak timber, each side being of one entire piece. The buckets, one of which is represented in Plate CCV., fig. 8, are perforated in the back and bottom with small holes for draining off the water. They measure one foot nine inches in depth, one foot two inches in width from back to breast at the bottom, and one foot five inches at the mouth; the breadth from side to side is two feet two inches. The mouth-piece or cutting edge *a* is of tempered steel; *b* is a side view of the double link connected with the bucket. Fig. 9 is an edge view of this link, fig. 10 a side view of the single link, and fig. 11 an edge view of it. These links are twenty-one inches long from centre to centre, three inches in breadth by two in thickness, with a ring of steel one fourth of an inch in thickness welded into the eye of each. The bolts for the chain are two inches in diameter, coated with steel. The weight of each double link is about 84 lbs. and of each single link about 44 lbs. The trussing rod for the bucket-frame, marked *u*, Plate CCIV. fig. 1, is three inches in breadth

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by one and a fourth inch in thickness, meeting in the centre, and forming a breadth of seven inches. The friction rollers along the upper side of the bucket-frame are ten in number, as shown in the longitudinal section; they are seven inches in diameter, with a flange measuring twelve inches in diameter. The bucket-frame is lowered and regulated upon the ground to be dredged by a tackle formed by two three-sheaved iron blocks, with 185 feet of three-fourth inch chain run through them for a tackle-fold. This tackle is suspended from a frame of cast iron, as shown at O, Plate CCIV., fig. 1, and is represented in dotted lines at P. It is attached to the bucket-frame by a malleable iron cross-bar and two side rods, the other end being attached to the cast-iron barrel already described. The iron ties marked *xx*, Plate CCIV., fig. 1, of which there are four, are used, along with the vertical beam, for supporting the extremity of the bucket-frame: they are of malleable iron, measuring five eighths of an inch in diameter.

The dredging vessel is moored with anchors of two and a half cwt. each, and is moved in any required direction when dredging, by means of four winches of cast iron, viz. one of double power on each bow of the vessel, having a five-eighth inch chain of 300 feet in length, with couplings, and one single-power crab on each quarter, with two iron leading-locks, having also 300 feet of half-inch chain. This vessel and its apparatus requires nine men to work it; when dredging in clean gravel it will discharge into the receiving-barges at the rate of 120 tons per hour; the period for working is regulated by the tides, but generally about four hours is obtained each tide, or eight hours per day, which is equal to 960 tons. But when the machine works upon a clayey bottom, about sixty tons per hour may be taken as the average quantity lifted; and when the stuff is mixed with gravel and stones, the quantity is still less. It is not uncommon with the buckets to take up stones of upwards of one hundredweight, and occasionally the roots of large trees.

In some instances the receiving barges are built with a hold for carrying their load, especially where the mud or sleet is thin. It is received into plate-iron tanks, fitted so as to fill the hold. (Tanks of this description, which contain about one ton each, are used at the harbour works of Dundee.) They are fitted with ears or handles, and are lifted out of the boat by a tackle, and emptied into ships as ballast, or they are landed on the quay to be otherwise disposed of. But where these excavated matters are not found necessary for the purposes of the port, they are thrown into deep water, for accomplishing which the barges are furnished with a copper-hold and flap-doors in the bottom, for letting off the stuff, as shown in Plate CCIV., fig. 13.

Though we have not been able to trace the invention of the bucket-dredging machine to any particular person, yet we believe it is strictly of British origin, and, so far as our information goes, was first used at the port of Hull in the Humber. It may here be curious to remark, that Jo-

nathan Hulls was of that place; he obtained a British patent for working vessels by steam in 1735, although, strange to say, it was not introduced into practice till 1812, when the late Mr Henry Bell fitted out the canal steam-boat upon the Clyde. Since that period the steam dredging machine has come into very general use. On the Clyde there are now no fewer than three such vessels as we have described employed, besides a diving bell for the removal of large boulder stones, which in various parts obstruct that navigation. The engines and apparatus used on the Clyde are chiefly of the manufacture of Messrs Girdwood and Berry of Glasgow.

The dredging machine delineated in Plates CCIV. and CCV. was constructed by Messrs John Duffus and Company, Aberdeen. As before noticed, it is simple in its form, and contains the latest improvements both in the build of the vessel and the position and arrangement of the machinery. The great object to be attended to in framing these vessels is, to obtain such a degree of strength as not only to withstand the tremulous motion of the engine and dredging buckets, but also to be capable of resisting the strains to which they are continually liable in taking the ground, or in the fair way of shipping.

The cost of the vessel, engine, and bucket apparatus, complete, with her twelve lighters, may be taken at L.5000. The expenditure of coal is at the rate of four cwt. per hour, and the daily expense of working her at L.3. 3s. But these items of course vary in amount, according to local circumstances and the situation of the port.

The strength of the vessel, the power of the engine, fitness of the machinery, and the security of the whole against accident by fire, are circumstances connected with the application of the dredging-machine which will always meet with the attentive consideration of the engineer, whose regulation in all the parts of this apparatus will be guided by the actual operation to be performed, as more or less suitable to the peculiar situation of the works in which this apparatus is to be employed. What we have been able to bring under the professional reader's notice in this article, we trust will be sufficient to give him an idea, not only of the construction of the apparatus, and the principles upon which it acts, but also to afford such details as cannot fail to be highly useful in the construction of such an apparatus. To the general reader, who may not take much interest in the details of complicated machinery, we presume our section, elevation, and plan of the bucket dredging-machine will be sufficiently obvious. To him it will also have been interesting to know how operations of this kind are performed, the quantity of work that may be done, and the rate of its expense. We shall also be happy if our observations upon the baneful consequences of shutting out tide water by embanking shall happen to come under the eye of those possessed of legislative power, and be the means of rendering more effective the act of 1800, for the preservation of the navigable rivers of the kingdom, as noticed at page 193. (T. T.)

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DRELINCOURT, CHARLES, minister of the Calvinist church at Paris, was born in July 1595, at Sedan, where his father held a considerable office. He had all the qualifications which constitute a respectable clergyman; and though he defended the Protestant cause against the Roman Catholic religion, he was much esteemed even amongst the Catholics. He is best known in England by his *Catechism* and *Consolations against the Fears of Death*, works which have been translated, and frequently reprinted. His controversial works are numerous, and include the *Jubilee*, the *Roman Combat*, the *Jesuit's Owl*, an *Answer to*

Father Coussin, *Disputes with the Bishop of Bellai*, an *Answer to Lamilletière*, *Dialogues against the Missionaries*, the *False Paster convicted*, the *False Face of Antiquity*, the *Pretended Nullities of the Reformation*, an *Answer to Prince Ernest of Hesse*, an *Answer to the Speech of the Archbishop of Sens*, and a *Defence of Calvin*. He married the daughter of a rich merchant at Paris, by whom he had sixteen children. His third son, professor of physic at Leyden, was physician to the prince and princess of Orange before their accession to the crown of England. Bayle has given him a high character. Mr Drelincourt died in November 1660.

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DRENTHE, one of the provinces of the Netherlands, bounded on the north and east by Groningen, on the south-east by the kingdom of Hanover, on the south and south-west by Overijssel, and on the north-west by Friesland. It is 820 square miles in extent, and contains 46,470 inhabitants, in three towns and thirty-seven villages. The capital is Assen. It is generally a poor, cold, heathy district, depending chiefly on its breed of cattle, and on the sale of wool, honey, wax, and turf, and on the conveyance of the latter for fuel to other and larger towns that are within the province.

DRESDEN, a city of Germany, the capital of the former electorate, now the kingdom of Saxony. It is a beautiful spot, both as regards the position and the buildings. The river Elbe divides it into two unequal parts, over which is a fine bridge of sixteen arches, 1420 feet in length and thirty-six in breadth, which, though destroyed in the French revolutionary war, has again been restored. It was fortified, but the works now serve the purposes merely of police. There are seven market-places or squares, and about sixty broad streets, with others connecting them together; and the public buildings, which are numerous and beautiful, give to the whole a most magnificent appearance, but especially in the new town, which is of more recent erection.

There are seventeen Lutheran, two Catholic, and a small Calvinist church; the most remarkable are the Frauenkirk of the Protestants, and the elegant Catholic church connected with the royal palace. Over the altar of the latter is a painting of the ascension by Mengs, highly valued.

Dresden has obtained the name of the Athens of the north, from the various collections of the fine arts and of antiquities that are to be seen there. The palace is spacious and noble, and in the repository in the *Grünen Gewölbe* is arranged a collection of antiquities connected with the ancient history of the country, of very great value. The zwenger or barbican is a beautiful circular building. The garden serves the purposes of a promenade, and the apartments are used as the repository of a valuable cabinet of natural history. The picture gallery occupying the four sides of a square building is peculiarly rich in specimens of art of the best and oldest masters, and is said to be the best in Europe at the present time. The Japan palace, in a garden looking on the Elbe, contains the royal library, amounting to more than 150,000 volumes, a collection of porcelain, and many of the finest specimens both of ancient and modern statuary. The chancery house is a fine building, and, besides several paintings, contains some most valuable records of the historical kind. The other public and private houses deserving attention are numerous, and will reward the curious visitor who shall devote his time to their minute examination.

The institutions for benevolence and for instruction are numerous, appropriate, and well conducted. The surrounding country presents many objects which induce pleasing walks or rides, especially the Plaunesche-grund, where a rapid stream runs between lofty rocks, the palace of Pillnitz on the banks of the Elbe, and the gardens which surround a part of the city.

There are many manufactures carried on of gold and silver articles, silk goods, cotton and woollen cloth, gloves, hosiery, and other minute commodities. A considerable quantity of wine is made from the vineyards on the sides of the hills overlooking the Elbe. Dresden has suffered in its population by war in 1745, 1756, 1811, and especially in 1813. The inhabitants amount to 49,000, of whom 5000 are Catholics, 200 Calvinists, 860 Jews, and forty Hussites.

DREVET, PETER, the younger, an eminent French

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engraver, was a member of the royal academy of painting and sculpture, and died at Paris in 1739, at the age of forty-two. His portraits are neat and elegant, but laboured to the last degree. He particularly excelled in representing lace, silk, fur, velvet, and other ornamental parts of dress. But the younger Drevet did not confine himself to portraits. We have several historical prints by him, which in point of neatness and exquisite workmanship are scarcely to be equalled. His most esteemed and best historical print is very valuable; but the first impressions of it are rarely to be met with. It is *The Presentation of Christ in the Temple*; a very large plate, lengthwise, from Luigi de Bologna. Among his portraits, the two held in the highest estimation are, that of Bossuet, bishop of Meaux, a whole length figure standing, a middling sized upright plate, from Rigaud; and that of Samuel Bernard, a whole length figure sitting in a chair, a large upright plate. The first impressions of the last are before the words *Conseiller d'Etat* were inserted upon the plate.

DREUX, an arrondissement in the department of the Eure and Loire, in France, extending over 620 square miles, and divided into seven cantons and 138 communes, with 71,506 inhabitants. The chief city, of the same name, is situated on the river Blaise, and contains 860 houses, with 6037 inhabitants. Long. 1. 16. 19. E. Lat. 48. 44. 17. N.

DRIESEN, a city of Prussia, in the province of Brandenburg, surrounded by the two rivers Netze. It contains 317 houses, and 2565 inhabitants, mostly weavers of linen and woollen cloth, or employed in distilleries.

DRIFFIELD, a market-town in the wapentake of Hart-hill, in the east riding of Yorkshire, 197 miles from London. There is a market which is held on Thursday. The inhabitants amounted in 1801 to 1411, in 1811 to 1857, and in 1821 to 2303.

DRIFT, in *Navigation*, the angle which the line of a ship's motion makes with the nearest meridian, when she drives with her side to the wind and waves, and is not governed by the power of the helm; it also implies the distance which the ship drives on that line. A ship's way is only called *drift* in a storm, and then when it blows so vehemently as to prevent her from carrying any sail, or at least restrains her to such a portion of sail as may be necessary to keep her sufficiently inclined to one side, that she may not be dismasted by her violent labouring produced by the turbulence of the sea.

DRIFT, in mining, a passage cut out under the earth betwixt shaft and shaft, or turn and turn; or a passage or way wrought under the earth to the end of a meer of ground, or part of a meer.

DRIFT-Sail, a sail used under water, veered out right a-head by sheets, as other sails are. It serves to keep the ship's head right upon the sea in a storm, and to hinder her from driving too fast in a current.

DRIFT-Wood, trees or timber carried out to sea by the rivers when in flood, and then drifted about in various directions, and to different parts, by the currents of the ocean.

DRILL, in *Mechanics*, a small instrument for making such holes as punches do not conveniently serve to form. Drills are of various sizes, and are chiefly used by smiths and turners.

DRILLING is popularly used for exercising soldiers. The word is derived from the French *drille*, which signifies a *raw soldier*.

DRINK, a part of our ordinary food in a liquid form. See **DIETETICS**.

DRISSA, a circle in the Russian government of Witepsk. It is bounded on the north by Sebesk, on the east by Polozk, on the south by Minsk, and on the west by Resitza. It is watered by the Düna and its tributary streams, and

Driving is fertile in rye, flax, and black cattle. The inhabitants amounted in 1797 to 51,400, who have since that census rapidly increased. It contains four cities and 1055 villages. The capital, of the same name, is situated on the river Drissa, where it falls into the Düna. It is a small town, with a slight but growing population.

DRIVING, in *Metallurgy*, is said of silver, when, in the operation of refining, the lead being burnt away, the remaining copper rises upon its surface in red fiery bubbles.

DRIVING, in the sea language, is said of a ship when an anchor being let fall does not hold her fast, nor prevent her sailing away with the wind or tide. The best help in this case is to let fall more anchors, or to veer out more cable; for the more cable she has out, the safer she rides. When a ship is a-hull or a-try, they say she drives to leeward.

DROGHEDA, a town in the province of Leinster, in Ireland, situated in the middle of a small district called the county of the town of Drogheda, between the counties of Louth and Meath, is built on both sides of the river Boyne, about five miles from its mouth, and thirty miles north of the city of Dublin. The entire extent of the county is 5800 acres, or nine square miles. In the earliest notices of it by ancient writers it is called Inver-Colpa, or the Port of Colpa, and afterwards Tredagh. Drogheda, the name it is at present known by, signifies "the Bridge over the Ford." The portions on each side of the Boyne were formerly distinct towns, under separate jurisdictions, distinguished by the names of Drogheda on the side of Meath, and Drogheda on the side of Uriel, the ancient appellation given to the county of Louth and some adjoining districts. It is now divided into the parishes of St Peter, St Mary, and part of that of Ballymakenny; and in the year 1813 it contained a population of 16,000 souls, in 1821 of 18,118, and in 1831 of 17,365; being the only place in Ireland whose numbers did not increase in the interval between the two last-mentioned dates. It ranks in amount of inhabitants the eighth of the chief cities and towns in Ireland.

The municipal government of the town is vested in the mayor, two sheriffs, two justices of the peace, and a recorder, who hold under a charter granted under the following singular circumstances: Whilst the town was split into two independent jurisdictions, the inhabitants were incessantly in a state of mutual hostility, in consequence of trading vessels landing their cargoes in the southern town, to avoid the payment of pontage duty levied on all vessels discharging on the northern or Louth side. Much blood was frequently shed on these occasions. At length Philip Bennett, a monk residing in the town, took occasion, on the festival of Corpus Christi, to preach a sermon before the constituted authorities of both sides, in which he inculcated the blessings of union so emphatically, and followed up the subject so effectively at an entertainment to which he invited them in his convent the same day, that they all joined in sending a deputation to Henry IV. to obtain a new charter, by which both parts were embodied into a single corporation. This event took place in the year 1412. The charter was afterwards confirmed with alterations by James I. The mayor was honoured by Edward IV. with a sword of state, and L.20 a year for its maintenance, in reward of the services performed by the townsmen in an engagement at Malpas Bridge, where this magistrate, at the head of 500 archers and 200 pole-axemen, contributed to the defeat of O'Reilly and his confederates. Previously to the union Drogheda returned two members to parliament. The number has since been reduced to one, who is elected by a constituency consisting of 531 freemen and 407 freeholders and leaseholders, the total number of electors being 560.

The town has always been considered by the English as a place of much importance. In the reign of Edward III. it was classed, along with Dublin, Waterford, and Kilkenny, as one of the four staple towns of Ireland. Richard II. received in it the submissions of O'Neal, O'Donnel, and other chieftains of Ulster and Leinster. The right of coining money was granted to it. Parliaments were several times assembled in it, in one of which the value of money was raised, by altering the silver groat or four-penny piece to sixpence. In another parliament, also held here, in the beginning of the reign of Edward IV., the town was granted the right of having a university, with the same privileges as that of Oxford. The plan however failed, owing to the poverty of the town and the unsettled state of the country; and an attempt lately made by the corporation to re-assert the right was also unsuccessful. One of the Earls of Desmond was beheaded here on a charge of high treason, brought against him in parliament by the Earl of Worcester when lord lieutenant. Here also the celebrated statutes known by the name of Poyning's laws, which made such a change in the political relations between England and Ireland, were enacted. In the civil wars of 1641 the town was besieged by O'Neal and the northern Irish forces; but was gallantly defended by Sir Henry Tichbourne, and after a long blockade relieved by the Marquis of Ormond. The same nobleman relieved it a second time, when invested by the parliamentary army under Colonel Jones. In 1649 Cromwell appeared before it at the head of a numerous and well-appointed army. The town was taken after a short though spirited defence; and every individual in it, without distinction of age or sex, was put to the sword, after promise of quarter given. Thirty only escaped the butchery, who were afterwards transported as slaves to Barbadoes. In 1690 it was garrisoned by King James's army; but after the decisive battle of the Boyne it surrendered to the conqueror without a struggle, in consequence of a threat that quarter would not be granted if it were taken by storm. Its subsequent history is not marked by any circumstance of striking political notoriety.

Of the ancient fortifications very few relics remain. The only one of its four gates still in existence is that of St Laurence, which forms a very picturesque object. The modern town, built chiefly on the northern bank of the Boyne, is divided into four principal parts or quarters, by the two main streets that intersect each other at the Tholsel. The bridge which connects this portion with the southern is narrow, and by no means well suited to the great and increasing current of passengers and vehicles that take advantage of it. The principal public buildings are, the mayoralty-house, to which a suite of assembly-rooms is attached; the Tholsel, a square building of cut stone, with a cupola; the corn-market, the linen-hall, two parish churches, and several Roman Catholic chapels, the largest of which is that of St Peter. There are also several religious houses, in one of which, the abbey of Dominican nuns, without St Laurence's gate, is still preserved the head of Oliver Plunket, Roman Catholic archbishop of Armagh, who was executed at Tyburn in the year 1681, on an unfounded charge of treason. His body, having been interred in St Giles', London, was afterwards removed to the Continent. A classical school, under the endowment of Erasmus Smith, is maintained here. There are also several free schools, the principal of which, called the Patrician school, accommodates 150 pupils. Among the charitable institutions is one for the reception of thirty-six clergymen's widows, who are each provided with a house and an annuity of L.26 during life, arising from bequests made by two archbishops of Armagh. Here is also an alms-house for twenty-four aged widows, an infirmary, and a mendicity asso-

Drohicyn ||
Droitwich. ciation for the suppression of street-begging, in which the inmates are provided with food and employment, but are not lodged.

The former importance of Drogheda may also be inferred from the numerous remains of its monastic institutions. The principal were, the hospital of St Mary, for the sick and infirm; the priory of St Laurence, which was granted to the corporation on the dissolution of the monasteries; the Dominican friary, of which a tower of stately proportions still exists; the Grey friary and the Augustinian friary; all in the northern part of the town. On the southern side were the hospital of the Knights of St John of Jerusalem, and the Carmelite friary. The archbishops of Armagh had a palace in the town, built by Archbishop Hampton about the year 1620.

Drogheda was until lately the seat of an extensive manufacture of coarse linens, on the decline of which the cotton manufacture supplied its place. Brewing and tanning are carried on largely. Four fairs are held annually on May 12, June 22, August 26, and October 29. It is also a great place of export for grain, hides, and butter. Vessels of two hundred tons can lie at the quay. The communication with the country is facilitated by means of the Boyne navigation, which is carried on for nine miles, chiefly in the bed of the river, to Slane; six miles of still water navigation continue it thence to Navan, and seven more to Trim. The chief articles conveyed by it are coal, slate, timber, iron, and salt upwards; grain, yarn, and linen downwards. The salmon fishery on the Boyne was once very valuable; the fish is highly esteemed for its flavour.

About four miles west of the town is the village of Old Bridgetoun, memorable for the celebrated and decisive victory gained by King William over King James, his unfortunate competitor for the crown of Great Britain. The battle, which marks one of the great epochs in Irish history, is fully detailed in every general account of the country. The precise point where the main body of the British army crossed the Boyne during the action, and where the aged Duke Schomberg was killed whilst leading on his men, is marked by an elegant obelisk 150 feet high, having on each side of its pedestal an appropriate inscription.

DROHICYN, a circle in the Russian government of Bialystock, on the southernmost division of it. It is about 1100 square miles, or 704,000 acres in extent, and contains six cities, one market-town, and 112 villages, with, in 1797, 49,651 inhabitants, who are estimated to have increased in 1827 to 68,000. The chief place, of the same name, is situated on the river Bug, and contains a college, in which are 250 noble students, a Franciscan and a Benedictine monastery, and four churches. Long. 22. 38. E. Lat. 51. 4. N.

DROHOBICZ, a city of the circle of Sambor, in the Austrian kingdom of Galicia. It stands on the river Tesmenica, which empties itself into the Dniester. It is a place of considerable trade, especially in corn, cattle, and salt. It contains several churches, monasteries, and public schools, with 1200 houses, and about 8000 inhabitants, among whom are a great number of Jews. The salt mines produce annually about 3700 tons of refined salt.

DROITWICH, a town of the hundred of Halfshire, in the county of Worcester, 118 miles from London. It is situated in a valley filled with salt springs, which, when reached, rise nearly to the surface; a circumstance supposed to proceed from a subterranean river passing through the masses of rock-salt which are excavated in Cheshire. The water from the springs is fully saturated, so that common salt will not dissolve in it. The salt is procured by evaporating the water, which yields about seven times as

much salt as an equal quantity of sea water. The cheapness of coal causes an extensive making of salt, which supplies the neighbourhood. There is a canal joining the Severn, by which much salt is conveyed to Worcester, Gloucester, and Bristol, from which last city much is exported to distant markets. It is an ancient borough, lately sending two members to parliament, but now only one. The market is held on Friday. The inhabitants amounted in 1801 to 1845, in 1811 to 2079, in 1821 to 2176, and in 1831 to 2487.

DROME, a department of France, formed out of the districts Valentinois and Divis, of the ancient principality of Dauphiné. It is bounded on the north by the department of the Isère, on the east by that and the Upper Alps, on the south by the Lower Alps and Vaucluse, and on the west by the Ardèche, from which the Rhone separates it. The extent is 2722 square miles, or 692,750 hectares. The whole department consists of mountains, with valleys between, the entrances to which are commonly very narrow. The mountains increase in height on removing from the Rhone. At first they are sandy, then calcareous, and the highest of all are granite. Cultivation is in a languid state; the produce of corn is insufficient for the consumption, and 200,000 bushels are annually required from the surrounding districts to feed the population. They are enabled to obtain this in exchange for olives, almonds, nuts, silk, and hermitage wine, which the great heat of the summers brings to perfection under the shelter of the mountains. Much fuel also is collected, as one sixth of the land is covered with wood. Many sheep too are bred, but of an inferior race, producing a coarse wool. The manufacturing industry is confined to making some coarse woollen cloths, a few silk goods, and some domestic utensils for the supply of the inhabitants. The population amounts to 252,847 persons, of whom 34,500 are of the reformed church. None of them are rich or poor, but in moderate and nearly equal circumstances. It is divided into four arrondissements, twenty-eight cantons, and 360 communes. The capital is the city of Valence.

DROMEDARY. See **MAMMALIA**.

DROMORE, a town of Ireland, in the county of Down, situated on the river Lagan. It is a very ancient town, and the seat of a bishopric. The see was founded by St Colman in the sixth century. Besides the cathedral, which is small, there are two meeting houses. The population amounts to 1942. Dromore is situated fifteen miles southwest of Belfast.

DRONE, the male of the honey bee. Sometimes other flies also are so named. See **BEE**.

DRONERO, a city of Italy, in the province of Coni, and kingdom of Sardinia. It stands on the river Maria, is surrounded with walls, and contains six parish churches, one capuchin monastery, and 6440 inhabitants. There is a very considerable linen manufactory in the city.

DRONFIELD, a town of the hundred of Scarsdale, in the county of Derby, 157 miles from London. It has a well-endowed free school, founded in the reign of Elizabeth. The inhabitants amounted in 1801 to 1182, in 1811 to 1343, in 1821 to 1522, and in 1831 to 1653.

DRONTHEIM, the northernmost province of the kingdom of Norway, extending from 61. 41. to 71. 11. north latitude. It extends over 64,284 square miles, but the population amounts to no more than 239,712 individuals, who inhabit six cities or towns and 115 parishes, which contain 262 churches and 110 chapels.

DRONTHEIM, the capital of the province of the same name in Norway, and the see of a bishop, is situated at the mouth of the river Nidelf, in a deep bay or fiord, in a most pleasing situation. It is walled, and was formerly de-

Drome
|
Dron-
them.

Dropsy fended by two forts, which are now in a dilapidated state. The streets are spacious, and the houses of respectable appearance, though all built of wood. The cathedral was once the most celebrated in the north, though now only the choir, in which the kings were formerly crowned, is entire. It has, besides, two churches, and 1400 houses, with 9000 inhabitants. The haven is secure, and causes some export trade in copper, planks, stockfish, herrings, and train oil. There are a few manufactures of linen cloth, and also refineries for sugar and saltpetre, besides tanneries and glove-making. Long. 10. 18. 47. E. Lat. 63. 25. 47. N.

DROPSY, in *Medicine*, an unnatural collection of water in any part of the body. See *MEDICINE*.

DROSSEN, a city of Prussia, in a marshy situation, on the river Lenze, in the province of Brandenburg, containing 476 houses, and 2883 inhabitants.

DROWNING. This term usually signifies the extinction of life by total submersion; but it ought also to be applied to that species of suffocation which is produced by the exclusion of atmospheric air from the lungs by any liquid; for the effects produced in all such cases are similar. Drowning, therefore, may be considered as having taken place when the animal perishes from immersion of its head, or even from the obstruction to the air passages by a fluid.

The ordinary phenomena of drowning may be witnessed by submerging a small animal in a glass vessel filled with water. The animal at first struggles violently, and is soon observed to make a forcible *expiration*, as is indicated by the escape of bubbles of air from its mouth and nose. It next attempts to inspire; an effort marked by the strong heaving of its thorax, and convulsive efforts of its abdominal muscles. This effort is vain, and is speedily followed by the extrication of a few more air bubbles from its lungs. These convulsive motions are repeated at shorter intervals, while smaller portions of air are forced from the lungs at each succeeding expiration, until the air cells are deprived of a considerable portion of the air they contained at the moment of submersion. Insensibility soon comes on; but convulsive movements of the limbs mark the progress of cerebral congestion, and the influence of unoxygenated blood on the centre of the nervous system.

After these struggles, the animal is apparently dead; but a feeble motion may still be perceived in the chest; and before it ceases altogether, the muscles of the thorax are once more thrown into action by an ineffectual effort to breathe. Brodie has remarked, that in drowning, the action of the heart and diaphragm cease almost at the same instant. Unless the animal be removed from the water before the movements of the heart and diaphragm have entirely ceased, it perishes, and a minute or two more are sufficient to destroy it. If the animal be removed from the water while the heart and diaphragm are yet in action, it may escape from the immediate risk of suffocation, but yet may die from injury to the brain produced by congestion of dark blood on that organ. Bichat, Cruickshank, and Brodie, have proved, that dark unoxygenated blood acts as a poison on the brain, causing diminished nervous energy, laborious respiration, feeble pulse, dilated pupils, stupor, and convulsive twitches of the voluntary muscles.

Signs of death from drowning.—The signs of death from drowning are *external* and *internal*. 1. The external signs most usually perceived are either a very pale countenance, or the face bloated and livid; the lips, and not unfrequently the whole head, swelled; the eyes half open, and the pupils much dilated; the tongue swelled, and protruded between the teeth, so as to be in contact with the inner surface of the lips; the lips and nose often lined

with a whitish froth; the chest and epigastrium tumid, and much arched; the ends of the fingers usually exco-riated; and the spaces under the nails often filled with sand or mud. 2. The most usual internal signs are more or less cerebral congestion; but in some cases no morbid change appears in the brain. We usually find the blood in the vessels of the head, and indeed in the whole body, of a blackish colour. There is generally frothy mucus in the trachæa, which is sometimes tinged with blood; the lungs are dilated and gorged with blood; the diaphragm descends low into the abdomen, and has lost more or less of its concave surface towards that cavity. The right cavities of the heart, and the great vessels connected with it, are gorged with black blood, whilst the left side and its vessels are usually found empty. The blood in the body always remains fluid, and readily flows wherever an incision is made. Water is sometimes found in the bronchial tubes and cells of the lungs; and not unfrequently some water has been swallowed in the act of drowning. These symptoms will generally enable us to detect a death from drowning, if we examine the body before putrefaction is advanced.

The immediate cause of death from drowning has given rise to much controversy; and physiologists have appealed to contradictory experiments and observations in support of their different hypotheses. But this difference of opinion has originated in physiologists supposing that the suspension of the vital functions on submersion always depended on the same proximate cause. It is singular that the very dissimilar appearances which the face presents in different cases did not suggest some difference in the cause of death. In some drowned persons, the face is remarkably pale, and rather pinched; in others, the countenance is livid, and the whole head swelled; the first indicating the deficiency of blood in the head, the latter its redundancy. This led Dr Desgranges to the conclusion that there were two different modes in which drowning proved fatal.

The first, which he terms *nervous or syncopal asphyxia*, occurs when the person, either from the terror of impending fate, the effect of surprise, or from the sudden immersion in extremely cold water, faints at the instant of immersion. The instantaneous arrestation of the movements of the heart in such cases prevents the transmission of unoxygenated blood to the brain; the principle of life is merely suspended; the resources of the animal machine are not destroyed, but are capable of being again called into action by suitable means. The second Desgranges terms *asphyxia by suffocation*. In this species the heart continues to act for some time after respiration is impossible. The brain thus becomes loaded with black or unoxygenated blood, which is known to act as a direct sedative or a poison on that delicate organ. When this has gone on for a short time, its functions are annihilated, and cannot be restored when the body is again exposed to atmospheric air. In this second species water often finds its way into the air tubes, and even into the cells of the lungs, during the vain efforts of the individual to breathe.

These distinctions are important, will serve to explain most of the anomalies which have been observed as effects of submersion, and render probable the very extraordinary instances of resuscitation after long-continued submersion, which have been related by men worthy of credit, but which have appeared marvellous to those whose ideas of drowning are founded on a few experiments made on the lower animals forcibly submerged.

Amongst individuals who have recovered from insensibility induced by long submersion, by far the majority are those who have been affected by *syncopal asphyxia*, in whom there has been instantaneous arrestation of the mo-

Drowning. tion of the heart, and suspension of consciousness. This distinction will enable us also to explain why, when several persons are submerged together, some will be found quite irrecoverable; whilst others, who have been considerably longer under water, may be capable of resuscitation.

The recovery from *syncopal asphyxia* is well illustrated by a case given by Plater. A female, condemned for infanticide, was inclosed in a sack, according to the provisions of the *Caroline Code* of Germany, and thrown into a lake. She fainted at the moment of immersion; and, after having been under water for a quarter of an hour, was drawn out and restored to life.

Pouteau relates the history of a man at Lyons, who suddenly fell into a river covered with ice, and remained submerged for three hours, yet was restored to life by the long-continued assiduity of his medical attendant. Morgagni mentions the case of a man who was resuscitated after having been under water for half a day; and Pecklin relates the instance of a Swedish gardener, who was submerged in a frozen pond for sixteen hours, and yet was recovered by similar means.

In all such cases, Desgranges conceives that the capability of recovery is to be attributed to the sudden arrestation of the vital motions at the moment of immersion. The action of the heart and of the lungs ceasing simultaneously, no vitiated blood could be transmitted to the brain. A stop would at the same time be put to all secretions and excretions, so that there could be no expenditure of vital power. How long this suspension might continue without extinction of vitality, is unknown; but something resembling it occurs in some long-continued paroxysms of hysteria, and in persons who have for several days lain apparently dead, but have been resuscitated.

Drowning has been ascribed to water finding its way into the stomach and air passages; but this opinion was proved to be fallacious by Senac and Cullen. The former denied that water ever entered the lungs; but Morgagni showed that it actually does sometimes enter the air cells; and he ascribes the frothy mucus found in the fauces and air tubes to the intermixture of air with that water. The opinion of Morgagni on this last point is, however, incorrect; for the froth is found in many cases of asphyxia from noxious gases in epilepsy and apoplexy; and in the recent experiments of Dr M. Hall, it was observed in dogs that had been bled to death. It appears to be produced by the escape of air from the lungs mixing with the natural mucus lining the air passages, and indeed is common to all cases of laborious respiration. Goodwyn and Cullen showed the insufficiency of the water which finds its way into the lungs in drowning to cause speedy death.

The excoriation of the ends of the fingers is produced by the person endeavouring to save himself by catching at the bottom, or the first solid which meets his hands; and the sand and mud under the nails have the same origin. In fact, we are, by these marks, often able to discover whether a person has been drowned, or thrown into the water after death. The tumid state of the chest, and descent of the diaphragm into the abdomen, are caused by the violent efforts made to dilate the chest, for the relief of the sense of suffocation. The fluidity of the blood is remarkable, and seems almost universal in drowning. This appearance takes place wherever death is caused by the exclusion of oxygen, or when the blood does not undergo the usual changes in the lungs.

Treatment of drowned persons.—Various directions have been given for the treatment of persons who have been found in a state of asphyxia from submersion. The subject claimed the especial attention of De Haen, of John

Hunter, and Cullen, each of whom have made many judicious remarks on the best means of restoring animation; and the Humane Society of London have published twelve general rules for the recovery of drowned persons, which are, on the whole, useful, although some of them are now obsolete, and require emendation.

The principal objects in such cases should be,

1st, *To restore or keep up the animal heat.*

2d, *To induce a renewal of respiration.*

3d, *To rouse latent animation by the exhibition of stimuli.*

1. As soon as the body is removed from the water, the wet clothes should be taken off, and the body rolled in warm blankets or dry clothing, while it is transporting to the nearest house. The body should be carried in the arms of men, or on a bier, with celerity, but without jolting, to a room which, in hot weather, should have the windows open, but in winter should have a fire. The head, during the transporting, should not be suffered to hang down, but be laid in an easy position. When brought into the apartment in cold or damp weather, the body should be laid on a mattress before a fire, when the surface is to be diligently rubbed with dry warm flannel, both to dry the surface, and to rouse the excitability of the capillaries. Whilst this is going on, it is important to permit the free access of warm air. No more persons should be present than are useful about the patient; and the Humane Society limit the number to six. Sometimes the body has been placed in warm water; but this practice is objectionable. Some recent experiments have rendered it more than probable that the influence of the free application of air to the general surface of the body is not unimportant in restoring animation in cases of asphyxia; and the cutaneous circulation is more readily induced by dry and diligent frictions of the surface than by immersion in warm water. Applications of bags of hot sand, bran, or the like, to different parts of the body, as the arm-pits, scrobiculus cordis, and extremities, are obvious means of restoring animal heat not to be neglected; and in some instances much benefit seems to have been derived from switching the soles and palms with twigs, or striking them with the open hand. Whilst these means are being employed, we must not neglect the important object, viz.

2. The restoration of respiration, by *insufflation* of the lungs. The best and simplest mode of effecting this object is, to introduce the nozzle of a pair of common bellows into one nostril, whilst the operator closes the other nostril and the mouth with his left hand, and applies his right to the thyroid cartilage, pressing it gently backward, in order to shut up the *oesophagus*, and prevent the air entering the stomach instead of the lungs. The bellows should be wrought by an assistant, so as moderately to inflate the chest. A third person is to press the chest with his hands, to expel the air. These motions are to be alternated, so as to imitate natural breathing as much as possible. This mode of insufflation is much preferable to the proposal of introducing a tube into the *glottis*, and still more so to the hazardous operation of tracheotomy, which never can be necessary in a case of simple drowning, and which, even in the hands of the celebrated surgeon Mr Justamond, proved fatal, by permitting the infiltration of blood into the air passages.

When a sufficient supply of oxygen gas can be obtained, it would probably expedite recovery; but perhaps it should not in general be employed undiluted. Where a pair of bellows cannot be obtained, the life of a person may be saved by introducing any sort of pipe into the nostril, as above directed, and blowing air from the mouth of the operator into the lungs of the drowned person. In this case, care should be taken not to use the air from the lungs of the operator, but merely that which his mouth

Drowning. contains, thrown forward by the compression of his cheeks, in the manner used with the common blow-pipe. But a pair of bellows should always be preferred.

In the directions of the Humane Society, we read (art. 10) that the body, especially if the subject be a child, "is to be well shaken every ten minutes, in order to render the process of animation more certain." This practice is justly condemned by most modern authors, as either useless or dangerous. All the benefit of "shaking" may be obtained by frictions and switchings, without the risk of extinguishing the feeble remains of animation by rude concussions, "pullings, and pushings," which have been generally employed in cases of asphyxia. It is scarcely necessary to caution the practitioner against the exploded practice of hanging the drowned person by the heels, or laying him across a barrel with his head hanging downwards; a practice of which even Fothergill approves, on the principle of making him disgorge the water that might have found its way into the stomach and lungs, which was erroneously imagined to be the chief cause of suspended animation.

3. The application of various stimulants internally and externally, to facilitate resuscitation, is limited, but not unimportant. The vapour of ammonia, to irritate the Schneiderian membrane of the nose, has been generally adopted, and is useful in rousing the dormant excitability. When a tube can be introduced into the stomach, a portion of warm spirit and water, with or without ammonia, will generally be useful. The introduction of warm stimulants by the arms is likewise desirable, both to rouse the latent powers of life by their stimulant effect, and to restore the animal heat.

The eighth rule of the Humane Society recommends the injection of tobacco smoke into the fundament. This practice was borrowed from the savage Indians of North America; but it is of very questionable utility. The excessive faintness produced by this strong narcotic is a great objection to its employment in cases where the powers of life are already too low; and we have abundant means of exciting the peristaltic motion of the alimentary canal, by aloetic and other warm purgatives, without running the risk of extinguishing the feeble remains of vitality by the introduction of a narcotic. The objection is still stronger to infusions of the plant, which have also been recommended.

The application of Voltaic electricity bids fair to aid resuscitation, especially if not used too strong. It has a powerful effect in rousing the voluntary muscles, but its influence on the heart is doubtful. Yet there can be no doubt of its capability of stimulating the diaphragm and abdominal muscles, to cause the dilatation of the chest; and its application to the parts of the body most suitable for this end, as about the lower ribs and the pit of the stomach, should be tried. Common electricity is less suited to this purpose; but neither should be passed through the head, lest the excitability of the nervous system should be exhausted by so powerful and general a stimulant.

Blood-letting was reprobated by John Hunter; and in cases of drowning, when there are marks of *syncopal asphyxia*, it will probably prove injurious; but when there are decided marks of cerebral congestion, venesection under the direction of a medical practitioner will facilitate recovery.

These methods of resuscitation should be diligently employed for four or five hours at least, before the case is given up as hopeless. It is a vulgar and a dangerous error to suppose that because our efforts do not seem successful for one or two hours, that the patient is irrecoverably dead. There are instances of persons submerg-

ed, in whom no symptoms of returning animation have been obvious until after four, or even six hours of unremitting efforts.

(I. I. I.)

Drugget
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Druids.

DRUGGET, in commerce, a stuff sometimes all wool, and sometimes half wool half thread; sometimes corded, but usually plain. Those which have the woof of wool and the warp of thread are called *threaded druggets*; and those wrought with the shuttle on a loom of four marches are called *corded druggets*. As to the plain, they are wrought on a loom of two marches, with the shuttle, in the same manner as cloth, camblets, and other like stuffs not corded.

DRUIDÆ, or **DROIUM**, in *Ancient Geography*, a very ancient town, the principal place of the Druides or Druidæ in Gaul, as they are called; now *Dreux* in the Orleanois. Here, according to Cæsar, they met every year in a consecrated grove. The town was also called *Durocases*. Long. 1. 21. W. Lat. 48. 45. N.

DRUIDS, **DRUIDES**, or **DRUIDÆ**, the priests or ministers of religion amongst the ancient Celtæ or Gauls, the Britons, and the Germans.

Some authors derive the word from the Hebrew דְּרוּשִׁים, *derussim*, or *drussim*, which they translate *contemplatores*. Picard (*Celtopæd.* lib. ii. p. 58) believes the druids to have been thus called from *Druis* or *Dryius*, their leader, the fourth or fifth king of the Gauls, and father of Saron or Naumes. Pliny, Salmasius, Vigenère, and others, derive the name from δρυς, *quercus*, *oak*, on account of their inhabiting, or at least frequenting and teaching, in forests; or perhaps because, as Pliny says, they never sacrificed except under the oak. But it is hard to imagine how the druids should have come to speak Greek, even although Cæsar assures us that they had the Greek letters. Ménage derived the word from the old British *drus*, a dæmon or magician; and Borel, from the Saxon *dry*, a magician, or rather from the old British *dru* or *derw*, an oak; whence he supposes δρυς to be derived, which indeed is not an improbable supposition. Becanus (lib. i.) takes *druis* to be an old Celtic and German word, formed from *truwis* or *truwis*, a doctor of the truth and the faith; and in this etymology Vossius is disposed to acquiesce.

The druids were the first and most distinguished order among the Gauls and Britons. They were chosen out of the best families; and the honours of their birth, joined with those of their function, procured them the highest veneration among the people. They were conversant in astrology, geometry, natural philosophy, politics, and geography: they were the interpreters of religion, and the judges in secular affairs: whoever refused obedience to them was declared impious and accursed. We know but little as to their peculiar doctrines, only that they believed the immortality of the soul, and, as is generally supposed, in the metempsychosis; though it appears highly probable that they did not believe in this last doctrine, at least not in the sense of the Pythagoreans.

The chief settlement of the druids in Britain was in the isle of Anglesey, the ancient *Mona*, which they chose for this purpose, as it was well stored with spacious groves of their favourite oak. They were divided into several classes or branches, namely, the *vaccerri*, *bardi*, *eubages*, *symnothii* or *semnothi*, and *saronidæ*. The *vaccerri* are held to have been the priests; the *bardi* were the poets; the *eubages* were the augurs; and the *saronidæ* were the civil judges and instructors of youth. As to the *semnothi*, who are said to have been immediately devoted to the service of religion, it is probable that they were the same with the *vaccerri*. Strabo, however, and Picard after him in his *Celtopædia*, do not comprehend all these different orders under the denomination of Druids, as species under their genus, or parts under the whole, but make them quite different conditions or orders. Strabo in effect only distin-

Druids. guishes three kinds, *bardi*, *vates*, and *druids*. The *bardi* were the poets; the *vates*, *ωαταις*, apparently the same with the *vacerri*, were the priests and naturalists; and the *druids* were those who, besides the study of nature, applied themselves to that of morality.

Diogenes Laertius assures us in his prologue, that the druids were the same among the ancient Britons with the sophoi or philosophers among the Greeks, the magi among the Persians, the gymnosophists among the Indians, and the Chaldeans among the Assyrians.

Their garments were remarkably long; and, when employed in religious ceremonies, they always wore a white surplice. They generally carried a wand in their hands; and wore a kind of ornament enchased in gold about their necks, called the *druid's egg*. Their necks were likewise decorated with gold chains, and their hands and arms ornamented with bracelets. They wore their hair very short, and their beards remarkably long.

The druids had one chief or arch-druid in every nation, who acted as high priest, or *pontifex maximus*. He possessed absolute authority over the rest, and commanded, decreed, or punished, at pleasure. At his death he was succeeded by the most considerable amongst the survivors; and if there were several pretenders, the matter was ended by an election, or else put to the decision of arms.

The druids, we have observed, were in the highest esteem. They presided at sacrifices and other ceremonies, and had the direction of every thing relating to religion. The British and Gallic youth flocked to them in crowds to be instructed by them. With the children of the nobility, Mela tells us, they retired into caves, or the most desolate parts of forests, and kept them there sometimes for twenty years under their discipline. Besides the immortality and metempsychosis, their disciples were here instructed in the motion of the heavens and the course of the stars, the magnitude of the heavens and the earth, the nature of things, the power and wisdom of the gods, and a variety of other doctrines. They preserved the memory and actions of great men in their verses, which they never allowed to be written down, but made their pupils get by heart. In their common course of learning, they are said to have taught them twenty-four thousand such verses. By this means their doctrines appeared more mysterious by being unknown to all but themselves; and having no books to recur to, they were the more careful to fix these doctrines in their memory.

They worshipped the Supreme Being under the name of *Esus* or *Hesus*, and the symbol of the oak; and had no other temple than a wood or a grove, where all their religious rites were performed. Nor was any person admitted to enter that sacred recess, unless he carried with him a chain, in token of his absolute dependence on the Deity. Indeed their whole religion originally consisted in acknowledging that the Supreme Being, who made his abode in these sacred groves, governed the universe, and that every creature ought to obey his laws and pay him divine homage.

They considered the oak as the emblem, or rather the peculiar residence, of the Almighty; and accordingly chaplets of it were worn both by the druids and the people in their religious ceremonies, whilst the altars were strewed with its leaves and encircled with its branches. The fruit of it, especially the mistletoe, was thought to contain a divine virtue, and to be the peculiar gift of heaven. It was therefore sought for on the sixth day of the moon

Druids. with the greatest earnestness and anxiety, and when found it was hailed with raptures of joy. As soon as the druids were informed of this fortunate discovery, they prepared every thing for the sacrifice under the oak, to which they fastened two white bulls by the horns; then the arch-druid, attended by a prodigious number of people, ascended the tree, dressed in white, and, with a consecrated golden knife or pruning-hook, cropped the mistletoe, which he received in his *sagum* or robe, amidst the rapturous exclamations of the people. Having secured this sacred plant, he descended the tree; the bulls were sacrificed; and the Deity invoked to bless his own gift, and render it efficacious in those distempers in which it should be administered.

The consecrated groves, in which they performed their religious rites, were fenced round with stones, to prevent any person's entering between the trees, except through the passages left open for that purpose, and which were guarded by some inferior druids, to prevent any stranger from intruding into their mysteries. These groves were of different forms; some quite circular, others oblong, and more or less capacious as the votaries in the districts to which they belonged were more or less numerous. The area in the centre of the grove was encompassed with several rows of large oaks set very close together. Within this large circle were several smaller ones surrounded with large stones; and near the centre of these smaller circles were stones of a prodigious size and convenient height, on which the victims were slain and offered. Each of these being a kind of altar, was surrounded with another row of stones, the use of which cannot now be known, unless they were intended as cinctures to keep the people at a convenient distance from the officiating priest.

Suetonius, in his life of Claudius, assures us that the druids sacrificed men; and Mercury is said to have been the god to whom they offered these victims. Diodorus Siculus observes, that it was only upon extraordinary occasions they made such offerings; as, to consult what measures to take, or to learn what should happen to them, by the fall of the victim, the tearing of his members, and the manner in which his blood gushed out. Augustus condemned the custom, and Tiberius and Claudius punished and abolished it.

We learn from Cæsar that the druids were the judges and arbiters of all differences and disputes, both public and private; they took cognizance of murders, inheritances, boundaries, and limits, and decreed rewards and punishments. Such as disobeyed their decisions they excommunicated, which was their principal punishment; the criminal being thereby excluded from all public assemblies, and avoided by all the world, so that nobody durst speak to him, for fear of being polluted.¹ Strabo observes they had sometimes interest and authority enough to stop armies upon the point of engaging, and accommodate their differences.

It has been disputed whether the druids were themselves the inventors of their opinions and systems of religion and philosophy, or received them from others. Some have imagined that the colony of Phocians which left Greece and built Marseilles in Gaul about the 57th olympiad, imported the first principles of learning and philosophy, and communicated them to the Gauls and other nations in the west of Europe. It appears indeed that this famous colony contributed not a little to the improvement of that part of Gaul where it settled, and to the civilization of its inhabitants. "The Greek colony of Marseilles,"

Their opinions and philosophy.

¹ The *aquæ et ignis interdictio* of the Roman law was probably borrowed from and founded on the druidical excommunication, just as the "letters of intercommuning" in the reigns of Charles II. and James II. were a reproduction of the Roman penalty.

Druids. says Justin, "civilized the Gauls, and taught them to live under laws; to build cities, and enclose them with walls; to raise corn; to cultivate the vine and olive; and, in a word, made so great a change both in the face of the country and the manners of its inhabitants, that Gaul seemed to be translated into Greece, rather than a few Greeks transplanted into Gaul." But though we may allow that the druids of Gaul and Britain borrowed some hints and embellishments of their philosophy from this Greek colony, and perhaps from other quarters, there is some reason to believe that the substance of it was their own. Others have suggested that the druids derived their philosophy from Pythagoras, who published his doctrines at Crotona in Italy, where he lived above twenty years, in the highest reputation for his virtue, wisdom, and learning. This conjecture seems to be confirmed by the remarkable expression of Ammianus Marcellinus, "That the druids were formed into fraternities, as the authority of Pythagoras decreed." It has also been observed, that the philosophy of the druids bore a much greater resemblance to that of Pythagoras than to that of any of the other sages of antiquity. But it seems probable that Ammianus meant no more by the above expression than to illustrate the nature of the druidical fraternities, by comparing them to those of the Pythagoreans, which were well known to the Romans; and the resemblance between the Pythagorean and druidical philosophy may perhaps be best accounted for, by supposing that Pythagoras learned and adopted some of the opinions of the druids, as well as imparted to them some of his discoveries, or that both were derived from a common source. It is well known that this philosopher, animated by the most ardent love of knowledge, travelled into many countries in pursuit of it, and got himself admitted into every society that was famous for its learning. It is therefore highly probable in itself, as well as directly asserted by several authors, that Pythagoras heard the druids of Gaul, and was initiated into their philosophy.

Learning of the druids.

Physics.

From the concurring testimonies of several authors, it appears that physiology or natural philosophy was the favourite study of the druids of Gaul and Britain. Cicero tells us that he was personally acquainted with one of the Gaulish druids, Divitiacus the Æduan, a man of quality in his own country, who professed to have a thorough knowledge of the laws of nature, or of that science which the Greeks called *physics* or *physiology*. According to Diodorus Siculus, Strabo, Cæsar, Mela, Ammianus Marcellinus, and others, they entered into many disquisitions and disputations in their schools, concerning the form and magnitude of the universe in general, and of this earth in particular, and even concerning the most sublime and hidden secrets of nature. On these and similar subjects they formed a variety of systems and hypotheses, which they delivered to their disciples in verse, that the latter might the more easily retain them in their memories, since they were not allowed to commit them to writing. Strabo has preserved one of the physiological opinions of the druids concerning the universe, viz. that it was never to be entirely destroyed or annihilated, but was to undergo a succession of great changes and revolutions, which were to be produced sometimes by the power and predominacy of water, and sometimes by that of fire. This opinion, he intimates, was not peculiar to them, but was entertained also by the philosophers of other nations; and Cicero speaks of it as a truth universally acknowledged and undeniable. "It is impossible for us," says he, "to attain a glory that is eternal, or even of very long duration, on account of those deluges and conflagrations of the earth, which must necessarily happen at certain periods." This opinion, which was entertained by the most ancient phi-

losophers of many different and very distant nations, was probably neither the result of rational inquiry in all these nations, nor communicated from one of them to others, but descended to them all from their common ancestors of the family of Noah by tradition, though corrupted and misunderstood through length of time. The agreement of the druids with the philosophers of so many other nations in this opinion about the alternate dissolution and renovation of the world, gives us reason to believe that they agreed with them also in their opinion of its origin from two distinct principles: the one intelligent and omnipotent, which was God; the other inanimate and inactive, which was matter. We are told by Cæsar that they had many disquisitions about the power of God; and, no doubt, amongst other particulars, about his creative power. But whether they believed with some that matter was eternal, or with others that it was created, and in what manner they endeavoured to account for the disposition of it into the present form of the universe, we are entirely ignorant, though they certainly had their speculations on these subjects. We are only informed that they did not express their sentiments on these and similar heads in a plain and natural, but in a dark, figurative, and enigmatical manner. This might incline us to suspect that Pythagoras had borrowed from them his doctrines about numbers, to the mystical energy of which he ascribes the formation of all things; for nothing can be more dark and enigmatical than that doctrine. The druids disputed likewise about the magnitude and form of the world in general, and of the earth in particular, of which things they pretended to have a perfect knowledge. We know not what their opinions were about the dimensions of the universe or of the earth, but there is reason to think that they believed both to be of a spherical form. This is visibly the shape and form of the sun, moon, and stars, the most conspicuous parts of the universe; and hence it was natural and easy to infer that such was also the form of the world and of the earth. Accordingly this seems to have been the opinion of the philosophers of all nations; and the circle was the favourite figure of the druids, as appears from the form both of their houses and places of worship. Besides these general speculations about the origin, dissolution, magnitude, and form of the world and of the earth, the druids engaged in particular inquiries into the natures and properties of the different kinds of substances. But all their discoveries in this most useful and extensive branch of natural philosophy, whatever they were, have been entirely lost.

Druids.

Astronomy also appears to have been one of the chief studies of the druids of Gaul and Britain. "The druids," says Cæsar, "have many disquisitions concerning the heavenly bodies and their motions, in which they instruct their disciples." Mela, speaking of the same philosophers, observes, "that they profess to have great knowledge of the motions of the heavens and of the stars." Some knowledge of this science indeed was not only necessary for measuring time in general, marking the duration of the different seasons, regulating the operations of the husbandman, directing the course of the mariner, and for many other purposes in civil life; but it was especially necessary for fixing the times and regular returns of their religious solemnities, of which the druids had the sole direction. Some of these solemnities were monthly, and others annual. It was therefore necessary for them to know, with some tolerable degree of exactness, the number of days in which the sun and moon performed their revolutions, that these solemnities might be observed at their proper seasons. This was the more essential, as some of these solemnities were attended by persons from different and very distant countries, who were all to meet at one place

Astronomy.

Druids. on one day, and who must have had some rule to discover the annual return of that day.

Their method of computing time. The most perceptible division of time by means of the two great luminaries is into day and night; the former occasioned by the presence of the sun above the horizon, the latter by his absence, which is in some measure supplied by the moon and stars. The druids computed their time by nights, and not by days; a custom which they had received by tradition from their most remote ancestors, and in which they were confirmed by measuring their time very much by the motions of the moon, the mistress and the queen of night. As the changes in the aspect of that luminary are most conspicuous, they engaged the attention of the most ancient astronomers of all countries, and particularly of the druids, who regulated all their great solemnities, both sacred and civil, by the age and aspect of the moon. "When no unexpected accident prevents it, they assemble upon stated days, either at the time of the new or full moon; for they believe these to be the most auspicious times for transacting all affairs of importance." Their most august ceremony, that of cutting the mistletoe from the oak by the archdruid, was always performed on the sixth day of the moon. Nay, they even regulated their military operations by this luminary, and avoided, as much as possible, to engage in battle whilst the moon was on the wane. As the attention of the druids was so much fixed on this planet, it could not be very long before they discovered that she passed through all her various aspects in about thirty days; and by more accurate observations, they would gradually find, that the real time of her performing an entire revolution was very nearly twenty-nine and a half days. This would furnish them with the division of their time into months, or revolutions of the moon; of which we know with certainty they were possessed. But this period, though of great use, was evidently too short for many purposes, and particularly for measuring the seasons; which, they could not fail to perceive, depended on the influences of the sun. By continued observation they discovered that about twelve revolutions of the moon included all the variety of seasons, which began again and revolved every twelve months. This suggested to them that larger division of time called a year, consisting of twelve lunations or three hundred and fifty-four days, which was the most ancient measure of the year in almost all nations. That this was for some time at least the length of the druidical year, is both probable in itself, and apparent from the expression of Pliny, that "they began both their months and years, not from the change, but from the sixth day of the moon;" which is a demonstration that their years consisted of a certain number of lunar revolutions, as they always commenced on the same day of the moon. But as this year of twelve lunar months falls eleven days and nearly one fourth of a day short of a real revolution of the sun, this error would soon be perceived, and call for reformation; though we are not informed of the particular manner in which it was rectified. Various arguments might be collected to render it very probable that the Britons were acquainted with a year exact enough for every purpose of life when they were first invaded by the Romans; but it will be sufficient to mention one, which is taken from the time and circumstances of that invasion. The learned Dr Halley has demonstrated that Cæsar arrived in Britain, in his first year's expedition, on the 26th day of August; and Cæsar himself informs us, that at his arrival the harvest was finished, except in one field, which by some means or other was more backward than the rest of the country. This is a proof that the British husbandmen knew and used the most proper seasons for ploughing, sowing, and reaping. The druids, as we are told by Pliny,

had also a cycle or period of thirty years, which they called an age, and which likewise commenced on the sixth day of the moon; but that author has not acquainted us on what principle this cycle was formed, nor to what purpose it was applied. We can hardly suppose that this was the cycle of the sun, which consists of twenty-eight years, and regulates the dominical letters. It is more probable, that whilst the druids made use of the year of twelve lunar months, and had not invented a method of adjusting it to the real revolution of the sun, they observed that the beginning of this year had passed through all the seasons, and returned to the point whence it set out, in a course of about thirty-three years; which they might therefore denominate an age. Others may perhaps be of opinion that this thirty years cycle of the druids is the same with the great year of the Pythagoreans, or a revolution of Saturn. Some have imagined that the druids were also acquainted with the cycle of nineteen years, which is commonly called the cycle of the moon. But the evidence of this depends entirely on the truth of that supposition, that the Hyperborean island, which is described by Diodorus Siculus, was Britain, or some of the British isles. Amongst many surprising things, that author states, concerning the Hyperborean island, that "its inhabitants believed that Apollo descended into their island at the end of every nineteen years; in which period of time the sun and moon, having performed their various revolutions, return to the same point, and begin to repeat the same revolutions. This is called by the Greeks the great year, or the cycle of Meton."

We are told both by Cæsar and Mela, that the druids studied the stars as well as the sun and moon; and that they professed to know, and taught their disciples, many things concerning the motions of these heavenly bodies. From these testimonies we may conclude that the druids were acquainted with the planets, distinguished them from the fixed stars, and carefully observed their motions and revolutions. If this discovery was the result of their own observations, it would be gradual, and it would be a long time before they found out all the planets. They might perhaps have received assistance and information from Pythagoras, or from some other quarter. But whether this discovery of the planets was their own, or communicated to them by others, it is highly probable that they were acquainted with the precise number of these wandering stars. Dio Cassius says, that the custom of giving the name of one of the planets to each of the seven days of the week was an invention of the Egyptians, and from them was gradually communicated to all the other nations of the world; and that in his time this custom was so firmly established, not only among the Romans, but among all the rest of mankind, that in every country it appeared to be a native institution. The knowledge of the planets, and perhaps the custom of giving their names to the days of the week, was brought out of Egypt into Italy by Pythagoras, more than five hundred years before the beginning of the Christian era; and from thence it could not be very long before it reached Gaul and Britain. But though we have little or no reason to doubt that the druids knew the number and observed the motion of the planets, yet it may be questioned whether they had discovered the times in which these bodies performed their several revolutions. Some of the planets, as Jupiter and Saturn, take so great a number of years in revolving, that it required a very extraordinary degree of patience and attention to discover the precise periods of their revolutions. If we could be certain that the island in which the ancients imagined Saturn lay asleep was one of the British isles, as Plutarch intimates it was, we might be inclined to think that the British druids were not ignorant of the length of the period

Druids.

Their knowledge of the stars.

Druids. in which the planet Saturn performs a revolution; for that same author, in another treatise, tells us, that "the inhabitants of that island kept every thirtieth year a solemn festival in honour of Saturn, when his star entered into the sign of Taurus." If we could depend upon this testimony, we should have one positive proof that the druids of the British isles were acquainted with the constellations, and even with the signs of the zodiac; and that they measured the revolutions of the sun and planets, by observing the length of time between their departure from and return to one of these signs. But history supplies no direct evidence that this was really the case. The druids of Gaul and Britain, indeed, as well as the ancient philosophers of other countries, had a general plan or system of the universe, and of the disposition and arrangement of its various parts, in which they instructed their disciples. This is both probable in itself, and is plainly intimated by several authors of the greatest authority. But we cannot be certain whether this druidical system of the world was of their own invention, or was borrowed from others. If it was borrowed, it was most probably from the Pythagoreans, to whom they were the nearest neighbours, and with whom they had the greatest intercourse; or at all events from some oriental sect, order, or caste, of which many are of opinion that they originally sprung.

It has been imagined that the druids had instruments of some kind or other, which answered the same purposes as our telescopes, in making observations on the heavenly bodies. The only foundation of this very improbable conjecture is an expression of Diodorus Siculus, in his description of the famous Hyperborean island. "They say further, that the moon is seen from that island, as if she were but at a little distance from the earth, and having hills or mountains like ours on the surface." But no such inference can be reasonably drawn from this expression, which in reality merits little more regard than that which, according to Strabo, was said of some of the inhabitants of Spain, that "they heard the hissing noise of the sun every evening when he fell into the western ocean."

The application of the druids to the study of philosophy and astronomy amounts almost to a demonstration that they applied also to the study of arithmetic and geometry; for some knowledge of both these sciences is indispensably necessary to the natural philosopher and astronomer, as well as of great and daily use in the common affairs of life. If we were certain that Abaris, the famous Hyperborean philosopher, the friend and scholar of Pythagoras, was really a British druid, as some have imagined, we should be able to produce direct historical evidence of their arithmetical knowledge. For Iamblicus, in the life of Pythagoras, says, that "he taught Abaris to find out all truth by the science of arithmetic." It may be thought improbable that the druids had made any considerable progress in arithmetic, as this may seem to have been impossible by the mere strength of memory, without the assistance of figures and of written rules. But it is very difficult to ascertain what may be done by memory alone, when it has been long exercised in this way. We have had examples of persons who could perform some of the most tedious and difficult operations in arithmetic by the mere strength of memory. The want of written rules could be no great disadvantage to the druids, as the precepts of this, as well as of the other sciences, were couched in verse, which would be easily got by heart and long remembered. Though the druids were unacquainted with the Arabic numeral characters, which are now in use, we have no reason to suppose that they were destitute of marks or characters of another kind, which, in some measure, answered the same purposes, both in making and re-

cording their calculations. In particular, it is believed that they made use of the letters of the Greek alphabet for both these purposes. This seems to be pretty distinctly intimated by Cæsar, who, in speaking of the druids of Gaul, observes, that "in almost all other public transactions and private accounts or computations, they make use of the Greek letters." And this is further confirmed by what he says of the Helvetii, a people of the same origin, language, and manners, with the Gauls and Britons. "Tables were found in the camp of the Helvetii written in Greek letters, containing an account of all the men capable of bearing arms who had left their native country, and also separate accounts of the boys, old men, and women." There is historical evidence of the druids being also well acquainted with geometry. "When any disputes arise," says Cæsar, "about their inheritances, or any controversies about the limits of their fields, they are entirely referred to the decision of their druids." But besides the knowledge of mensuration which this implies, both Cæsar and Mela plainly intimate that the druids were conversant in the most sublime speculations of geometry; "in measuring the magnitude of the earth, and even of the world."

There are still many monuments remaining in Britain and the adjacent isles, which cannot so reasonably be ascribed to any race as to that of the ancient Britons, and which lead us to think that they had made great progress in this department of knowledge, and could apply the mechanical powers so as to produce very astonishing effects. As these monuments appear to have been designed for religious purposes, we may be certain that they were erected under the direction of the druids. Many obelisks or pillars, of one rough unpolished stone each, are still to be seen in Britain and its isles. Some of these pillars are both very thick and lofty, erected on the summits of barrows and of mountains; and some of them, as at Stonehenge, have ponderous blocks of stone raised aloft, and resting on the tops of the upright pillars. We can hardly suppose that it was possible to cut these prodigious masses of stone, some of them above forty tons in weight, without wedges, or to raise them out of the quarry without levers. But it certainly required still greater knowledge of the mechanical powers, and of the method of applying them, to transport those huge stones from the quarry to the places of their destination; to erect the perpendicular pillars, and to elevate the imposts to the tops of these pillars. If the prodigious stone in the parish of Constantine, Cornwall, was really removed by art from its original place, and fixed where it now stands, it is a demonstration that the druids could perform the most astonishing feats by their skill in mechanics. That the British druids were acquainted with the principles and use of the balance, we have reason to believe, not only from the great antiquity of that discovery in other parts of the world, but also from some druidical monuments which are still remaining in this island. These monuments are called *loggan stones*, or rocking stones, and each of them consists of one prodigious block of stone, resting upon an upright stone or rock, and so equally balanced, that a very small force, sometimes even that of a child, can move it up and down, though hardly any force is sufficient to remove it from its station. Some of these stones may have fallen into this position by accident, but others of them evidently appear to have been placed in it by art. That the ancient Britons understood the construction and use of wheels, the great number of their war-chariots and other wheel carriages is a sufficient proof; and that they knew how to combine them together and with the other mechanical powers, so as to form machines capable of raising and transporting very heavy weights, we have good rea-

Druids.

Druids. son to believe. In a word, if the British druids were wholly ignorant of the principles and the use of any of the mechanical powers, it was most probably of the screw, though even of this we cannot be certain.

Medicine. In Germany and in the northern nations of Europe the healing art was chiefly committed to the old women of every state; but in Gaul and Britain it was entrusted to the druids, who were the physicians as well as the priests of these countries. Pliny says expressly, that "Tiberius Cæsar destroyed the druids of the Gauls, who were the poets and physicians of that nation;" and he might have added, of the Britons. The people of Gaul and Britain were probably induced to devolve the care of their health on the druids, and to apply to these priests for the cure of their diseases, not only by the high esteem they had of their wisdom and learning, but also by the opinion which they entertained, that a very intimate connection subsisted between the arts of healing and the rites of religion, and that the former were most effectual when they were accompanied by the latter. It appears indeed to have been the prevailing opinion of the nations of antiquity, that all internal diseases proceeded immediately from the anger of the gods; and that the only way of obtaining relief from these diseases was by applying to the priests to appease their anger by religious rites and sacrifices. This was evidently the opinion and practice of the Gauls and Britons, who in some dangerous cases sacrificed one man as the most effectual means of curing another. "They are much addicted," says Cæsar, "to superstition, and hence those who are afflicted with a dangerous disease sacrifice a man, or promise that they will sacrifice one, for their recovery. For this purpose they make use of the ministry of the druids, because the latter have declared that the anger of the immortal gods cannot be appeased, so as to spare the life of one man, but by the life of another." This way of thinking also gave rise to that great number of magical rites and incantations with which the medical practices of the druids, and indeed of all the physicians of antiquity, were attended. "Nobody doubts," says Pliny, "that magic derived its origin from medicine, and that, by its flattering but delusive promises, it came to be esteemed the most sublime and sacred part of the art of healing."

Botany. That the druids made great use of herbs for medicinal purposes, there is sufficient evidence. They not only had a most superstitious veneration for the mistletoe of the oak, on a religious account, but they also entertained a very high opinion of its medicinal virtues, and esteemed it as a kind of panacea, or remedy for all diseases. "They call it," says Pliny, "by a name which in their language signifies *All-heal*, because they have an opinion that it cures all diseases." They believed it to be in particular a specific against barrenness, and a sovereign antidote against the fatal effects of poisons of all kinds. It was also esteemed an excellent emollient and discutient for softening and discussing hard tumours, and good for drying up scrofulous sores, and curing ulcers and wounds; and, provided it was not suffered to touch the earth after it was cut, it was thought to be a very efficacious medicine in epilepsy. It has been thought useful in this last calamitous disease by some modern physicians. The pompous ceremonies with which the mistletoe was gathered by the druids have been already described. The selago, a kind of hedge hysop resembling savin, was another plant much admired by the druids of Gaul and Britain for its supposed medicinal virtues, particularly in all diseases of the eyes. But its efficacy, according to them, depended very much upon its being gathered exactly in the following manner: The person who gathered it was to be clothed in a white robe; to have his feet bare, and washed in pure water; to

offer a sacrifice of bread and wine before he proceeded to cut it, which he was to do with his right hand covered with the skirt of his garment, and with a hook of some more precious metal than iron. When it was cut, it was to be received and kept in a new and very clean cloth. Gathered exactly according to this whimsical ritual, it was affirmed to be not only an excellent medicine, but also a powerful charm and preservative against misfortunes and unhappy accidents of all kinds. The druids also entertained a high opinion of the herb samolus or mashwort, from its sanative qualities, and gave directions for gathering it, not less fanciful than those which have already been mentioned. The person who was to perform that office was to do it fasting, and with his left hand; he was on no account to look behind him, nor to turn his face from the herbs he was gathering. It would be tedious to relate the extravagant notions they entertained of the many virtues of the vervain, and to recount the ridiculous mummeries which they practised in gathering and preparing it, both for the purposes of divination and physic. It is easy to see that Pliny's information was very imperfect; and that, like many of the other Greek and Roman writers, he designedly represented the philosophers of Gaul and Britain in an unfavourable light. The herb called *Britannica* by the ancients, which some think was the great water-dock, and others the *cochlearia* or scurvy-grass, was probably much used in this island for medicinal purposes, as it derived its name from Britain, and was thence exported to Rome and other parts. Though these few imperfect hints are all that we can now collect of the botany of the British druids, yet there is some reason to think that they were not contemptible botanists. Their circumstances were peculiarly favourable for the acquisition of this kind of knowledge. For as they spent most of their time in the recesses of mountains, groves, and woods, the spontaneous vegetable productions of the earth constantly presented themselves to their view, and courted their attention.

The opinions which, it is said, the druids of Gaul and Britain entertained of the anguinum or serpent's egg, both as a charm and as a medicine, are romantic and extravagant in a very high degree. This extraordinary egg was formed, as they pretended, by a great number of serpents, interwoven and twined together; and when it had been formed, it was raised up in the air by the hissing of these serpents, and was then to be caught in a clean white cloth before it fell to the ground. The person who caught it was obliged to mount a swift horse, and to ride away at full speed to escape from the serpents, who pursued him with great rage, until they were stopped by some river. The way of making trial of the genuineness of the egg was no less extraordinary. It was to be encased in gold, and thrown into a river, and if it was genuine it would swim against the stream. "I have seen," says Pliny, "that egg; it is about the bigness of a moderate apple, its shell is a cartilaginous incrustation, full of little cavities, such as are on the legs of the polypus; it is the insignia or badge of distinction of the druids." The virtues which they ascribed to this egg were many and wonderful. It was particularly efficacious in rendering those who carried it about with them superior to their adversaries in all disputes, and in procuring them the favour and friendship of great men. Some have thought that this whole affair of the serpent's egg was a mere fraud, contrived by the druids to excite the admiration and pick the pockets of a credulous people, who purchased these wonder-working eggs from them at a high price. Others have imagined that this story of the anguinum, of which there is an ancient monument in the cathedral at Paris, was an emblematical representation of the doctrine of the druids concerning the creation of the

Druids. world. The serpents, say they, represent the divine wisdom forming the universe, and the egg is the emblem of the world formed by that wisdom. It may be added, that the virtue ascribed to the anguinum, of giving those who possessed it a superiority over others, and endearing them to great men, may perhaps be intended to represent the natural effects of learning and philosophy. But in so doubtful a matter every one is of course at liberty to form what judgment he thinks proper.

Rhetoric. As the influence and authority of the druids in their country depended very much upon the reputation of their superior wisdom and learning, they wisely applied to the study of those sciences which most directly contributed to the support and advancement of that reputation. In this number, besides those already mentioned, we may justly reckon rhetoric, which was diligently studied and taught by the druids of Gaul and Britain, who to the charms of their eloquence were indebted for much of the admiration and authority which they enjoyed. They had indeed many calls and opportunities to display their eloquence, and to discover its great power and efficacy; as, when they were teaching their pupils in their schools; when they discoursed in public to the people on religious and moral subjects; when they pleaded causes in the courts of justice; and when they harangued in great councils of the nation, and at the heads of armies ready to engage in battle, sometimes with a view to inflame their courage, and at other times with a design to allay their fury, and dispose them to make peace. Though this last was certainly a difficult task amongst fierce and warlike nations, yet such was the authority and eloquence of the druids, that they frequently succeeded in it. "They pay a great regard," says Diodorus Siculus, "to their exhortations, not only in the affairs of peace, but even of war; and these are respected both by their friends and enemies. They sometimes step in between two hostile armies, who are standing with their swords drawn and their spears extended, ready to engage; and by their eloquence, as by an irresistible enchantment, they prevent the effusion of blood, and prevail upon them to sheath their swords. So great are the charms of eloquence and the power of wisdom even amongst the most fierce barbarians." The British kings and chieftains, who were educated by the druids, were famous for their eloquence. This is evident from the many noble speeches which are ascribed to them by the Greek and Roman writers. For though these speeches may not be genuine, yet they are a proof that it was a well-known fact that these princes were accustomed to make harangues on such occasions. This we are expressly told by Tacitus: "The British chieftains, before a battle, fly from rank to rank, and address their men with animating speeches, tending to inflame their courage, increase their hopes, and dispel their fears." These harangues were called, in the ancient language of Britain, *brosnichty kah*, which is literally translated by Tacitus, *incitamenta belli*, incentives to war. The genuine posterity of the ancient Britons long retained their taste for eloquence, and their high esteem for those who excelled in that art. "Orators," says Mr Martin, "were in high esteem, both in these islands (the Hebrides) and the continent, until within these forty years. They sat always among the nobles or chiefs of families in the streah or circle. Their houses and little villages were sanctuaries, as well as churches, and they took place before doctors of physic. The orators, after the druids were extinct, were brought in to preserve the genealogy of families, and to repeat the same at every succession of a chief; and upon the occasion of marriages and births, they made epithalamiums and panegyrics, which the poet or bard pronounced. The orators, by the force of their eloquence, had a powerful ascendant over

the greatest men in their time. For if any orator did but ask the habit, arms, horse, or any other thing belonging to the greatest man in these islands, it was readily granted him; sometimes out of respect, and sometimes for fear of being exclaimed against by a satire, which in those days was reckoned a great dishonour."

If the British druids, considering the times in which they lived, had made no contemptible proficiency in several parts of real and useful learning, it cannot be denied that they were also great pretenders to superior knowledge in certain vain and fallacious sciences, by which they excited the admiration, and took advantage of the ignorance and credulity, of mankind. These were the sciences, if they may be so called, of magic and divination, by means of which they pretended to work a kind of miracles, and exhibit astonishing appearances in nature; to penetrate into the counsels of heaven; to foretel future events, and to discover the success or miscarriage of public or private undertakings. Their own countrymen not only believed that the druids of Gaul and Britain were possessed of these powers, but they were celebrated on this account by the philosophers of Greece and Rome. "In Britain," says Pliny, "the magic arts are cultivated with such astonishing success, and so many ceremonies, at this day, that the Britons seem to be capable of instructing even the Persians themselves in these arts. They pretend to discover the designs and purposes of the gods. The Eubates or Vates in particular investigate and display the most sublime secrets of nature; and by auspices and sacrifices they foretel future events." They were so famous for the supposed veracity of their predictions, that they were not only consulted on all important occasions by their own princes and great men, but even sometimes by the Roman emperors. Nor is it very difficult to account for all this. The druids finding that the reputation of their magical and prophetic powers contributed not a little to the advancement of their wealth and influence, naturally endeavoured to strengthen and establish it by all their art and cunning. Their knowledge of natural philosophy and mechanics enabled them to execute such works, and to exhibit such appearances, or to make the world believe that they did exhibit them, as were sufficient to gain them the character of great magicians. The truth is, that nothing is more easy than to acquire this character in a dark age, and among an unenlightened people. When the minds of men are haunted with dreams of charms and enchantments, they are apt to fancy that the most common occurrences in nature are the effects of magical arts. The following strange story, which we meet with in Plutarch's Treatise of the Cessation of Oracles, was probably occasioned by something of this kind. "There are many islands which lie scattered about the isle of Britain, after the manner of our Sporades. They are generally unpeopled, and some of them are called the *Islands of the Heroes*. One Demetrius was sent by the emperor [probably Claudius] to discover these parts. He arrived at one of these islands [supposed by some to be Anglesey, but more probably one of the Hebrides] next adjoining to the isle of Britain before mentioned, which was inhabited by a few Britons, who were esteemed sacred and inviolable by their countrymen. Immediately after his arrival the air grew black and troubled, and strange apparitions were seen; the winds rose to a tempest, and fiery spouts and whirlwinds appeared dancing towards the earth." This was probably no more than a storm of wind, accompanied with rain and lightning, a thing neither unnatural nor uncommon; but Demetrius and his companions having heard that the British druids, by whom this isle was chiefly inhabited, were great magicians, imagined that it was raised by them, and fancied that they saw many strange and unnatural sights.

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The druids did not think proper to undeceive them; for when they inquired about the cause of this storm, they were told that it was occasioned by the death of one of those invisible beings or genii who frequented their isle; a wonderful and artful tale, very well calculated to increase the superstitious terrors of Demetrius and his crew, and to determine them to abandon this enchanted isle, with a resolution never to return. Stonehenge, and several other works of the druids, were, for many ages after the destruction of their whole order, believed to have been executed by the arts of magic and enchantment; nor is it improbable that they persuaded the vulgar in their own times to entertain the same opinion of these works, by concealing from them the real arts by which they had been erected. The natural and acquired sagacity of the druids, with their long experience and great concern in the conduct of affairs, enabled them to form very probable conjectures about the event of enterprises. These conjectures they pronounced as oracles when they were consulted; and they pretended to derive them from the inspection of the entrails of victims, the observation of the flight and feeding of certain birds, and many other mummeries. By these and similar arts they obtained and preserved the reputation of prophetic foresight among an ignorant and credulous people. But these pretensions of the druids to magic and divination, which contributed so much to the advancement of their fame and fortune in their own times, have brought very heavy reproaches upon their memory, and have made some learned moderns declare that they ought to be expunged out of the catalogue of philosophers, and esteemed no better than mere cheats and jugglers. This censure is evidently too severe, and might have been pronounced with equal justice upon all the ancient philosophers of Egypt, Assyria, Persia, Greece, and Rome, who were great pretenders to magic and divination, as well as the druids. "I know of no nation in the world," says Cicero, "either so polite and learned, or so savage and barbarous, as not to believe that future events are presignified to us, and may by some men be discovered and foretold." The only conclusion, therefore, that can be fairly drawn from the successful pretensions of the British druids to the arts of magic and of divination, is this: That they had more knowledge than their countrymen and contemporaries, but had not so much virtue as to resist the temptation of imposing upon their ignorance to their own advantage.

DRUM is a martial instrument in the form of a cylinder, hollow within, and covered at the two ends with vellum, which is stretched or slackened at pleasure by means of small cords or sliding knots. It is beat upon with sticks. Drums are sometimes made of brass, but most commonly of wood. The drum is said by Le Clerc to have been an oriental invention, and to have been brought into Spain by the Arabians, or perhaps rather the Moors.

Kettle DRUMS are two sorts of large basons of copper

or brass, rounded in the bottom, and covered with vellum or goat skin, which is kept fast by a circle of iron round the body of the drum, with a number of screws to screw up and down. They are much used among the cavalry, as also in operas, oratorios, concerts, and the like.

DRUMMOND, WILLIAM, was born at Hawthornden on the 13th of December 1585. His father was Sir John Drummond, descended from the family of Carnock, a branch of the more illustrious family of Stobhall, from which the king derives his remote lineage through Anabella Drummond, the mother of James the First. The poet's mother was Anne the daughter of William Fowler;¹ and she is described as "a woman of excellent breeding, and of a good and virtuous life." William was the eldest of four sons, and there were three daughters by the same marriage. The earlier part of his education he received at the High School of Edinburgh, where he began to distinguish himself by the superiority of his talents; and being afterwards removed to the university, which was then a very recent institution, he took the degree of A. M. in the year 1605. We are particularly informed that he did not confine his attention to the metaphysical learning commonly taught in the schools, but likewise applied himself to the study of mathematics and of ancient authors. During the following year, his father sent him to complete his education in France; and in the university of Bourges he is said to have devoted himself with great assiduity and success to the study of the civil law; a study necessary to a lawyer, and useful to a scholar. After an absence of four years, he returned to his native country in 1610; and his friends now expected that he would devote himself to the practice of a lucrative profession, for which he seemed eminently qualified by his talents and learning.² The bar must however have presented very few attractions to a youth of his elegant taste and delicate sensibility: the municipal law was then but a dreary path, beset with thorns which never blossomed; and, what was particularly discouraging, there was not a single elementary book, there were no institutions of our law, from which a young student could derive a comprehensive knowledge of those principles which were afterwards to direct his practice. His systematic doctrines were indeed to a great extent borrowed from the ancient civilians, and the study of the civil law was generally prosecuted in some foreign university; but, besides an indispensable attendance in the courts, his final preparation for the practice of his profession consisted in reading the statute law, and such collections of maxims and reports as were then circulated in manuscript. Nor was Drummond compelled by any domestic considerations to overcome his repugnance: he was beyond the reach of that original impulse which has directed many a lawyer to reputation and emolument; for, about the period of his return from the continent, the death of his father left him in possession of an estate sufficient to maintain him in the liberal style of a gentleman.

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¹ He is commonly described as Sir William Fowler, secretary to the queen, but this account of his quality is evidently erroneous. The secretary was his son, who bore the same name with himself; nor does it appear that either of them received the honour of knighthood. The son followed the queen to England; and a list of the officers of her council, dated in October 1603, describes him as "Secretarie, and Master of the Requests." (Lodge's Illustrations of British History, vol. iii. p. 209.) In 1587, we find him denominated parson of Hawick; and the records of the presbytery, 2 Sept. 1612, mention him as then dead. It is however more than probable that he continued a layman, and, at a period when such irregular proceedings were not uncommon, enjoyed the temporalities of that living without residence and without qualification. His poems are not unknown to those who are acquainted with the literary history of that age. Of some of his manuscripts, as well as those of his nephew, Mr Laing has given an account in the Transactions of the Society of Antiquaries of Scotland, vol. iv.

² President Lockhart is said to have averred, that if he had followed the legal profession, he might have made the best figure of any lawyer in his time. But the accuracy of this tradition, says Mr Maitland, "may reasonably be doubted. Drummond has left a record of the books read by him between 1606 and 1614, from which it is apparent that literature occupied a much larger portion of his attention than law. In the detail of his studies, which were in a great measure confined to the most popular poetry and romances of the time, he mentions no other work on law than the Institutes of Justinian." (Introduction to Drummond's Poems. Edinb. 1832, 4to.)

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He now retired to his family residence at Hawthornden, six miles from Edinburgh, and resumed the study of the Greek and Latin classics. The immediate vicinity presents an air of such romantic beauty, that a poet could scarcely have found a more suitable habitation: his house is erected on the edge of a woody cliff which overhangs the river Esk; and at one extremity of the variegated and sequestered glen stand the ruins of the baronial castle and the collegiate church of Roslin. The ancient caves of Hawthornden, and the adjacent moor of Roslin, where Comyn and Fraser gained a signal victory over the English, have likewise their peculiar effect in impressing the imagination. Near the poet's house is a seat hewn in the solid rock, and still described by the name of the Cypress-grove; a name which it obtained from the circumstance of his having frequented this spot when engaged in the composition of a work which bears that title.

Here Damon 'sat' whose songs did sometime grace
The murmuring Esk; may roses shade the place.

In this delightful seclusion he devoted himself to the general improvement of his mind, and to the occasional exercise of his fine talents; and many of his poems appear to have been composed about this period of his life.¹ He chiefly cultivated the familiarity of the university men, and other individuals of genius and learning: among his own countrymen, he enjoyed the particular friendship of the earl of Stirling, the earl of Ancram, Arthur Johnston, and John Adamson; and among the English poets, his greatest intimacy and correspondence was with Ben Jonson and Michael Drayton. The grandfather of Jonson was originally from Annandale, where Johnstone is still a very prevalent name. In the year 1619, when this celebrated poet had attained the age of forty-five, he travelled from London on foot, for the express purpose of paying Drummond a visit; and at Hawthornden he spent three or four weeks with every appearance of satisfaction.² The heads of some of Jonson's conversations on subjects of literature, together with his own impressions of Jonson's character, he committed to writing, with the manifest intention of occasionally referring to this as a private record: many years after his death, this paper was communicated to the public, apparently in a somewhat mutilated form; and as it does not represent his distinguished guest as altogether faultless, the amiable and esteemed writer has incurred the virulent and unmeasured censure of Mr Gifford, the late editor of Jonson's works.³ If Drummond had resembled some more recent authors, who have violated all the decencies of private life by ministering to the gross appetite of the public with ridiculous or disparaging tales of their friends and acquaintance, the justice of this strong condemnation could not safely have been disputed; but what person of ordinary can-

dour will thus censure an act which, to all human appearance, was entirely unconnected with malevolent or ungenerous motives?

The poet's tranquillity was exposed to a severe interruption from the unfortunate issue of his first love. He became deeply enamoured of a beautiful young lady, the daughter of Cunningham of Barns; he met with a suitable return, and a day was fixed for their nuptials, but before that day arrived, her life was terminated by a rapid fever. Such an event as this, which would have affected a lover of the most ordinary sensibility, could not but sink deeply into the heart of one who had assiduously cherished the softer feelings, and whose habits of seclusion were so directly calculated to preserve a lasting impression of melancholy. He was so overwhelmed with grief that he found it necessary to try the effect of a change of objects; and he accordingly retired to the continent, where he spent about eight years. His longest residence was at Paris and Rome; but he travelled through France, Germany, and Italy, visited the most celebrated universities, and conversed with men of learning. In the course of his peregrinations, he is said to have formed an excellent collection, not only of the ancient classics, but likewise of the best writers in the French, Italian, and Spanish languages. He presented to the university of Edinburgh a collection of books and manuscripts, of which he printed a catalogue in the year 1627, prefixing to it an appropriate preface written in Latin. Of this well-known collection, the value, that is, the extrinsic or pecuniary value, which was far from being inconsiderable at first, has been immensely increased by the lapse of two centuries. It contains many Scottish and English publications of singular rarity. When Drummond returned to Scotland, he found his countrymen divided by fears and animosities. He now spent some time at the residence of his brother-in-law Sir John Scot of Scotstarvet, a learned man, and an encourager of learning. Having continued in a state of celibacy till the age of forty-seven, he in 1632 married Elizabeth Logan; a lady in whom he traced a strong resemblance to his first mistress. She is commonly represented as the grand-daughter of Sir Robert Logan of Restalrig; but, according to Hay, her father, who was altogether unconnected with that family, was minister of Edleston in the county of Peebles, and her mother was the daughter of a shepherd.⁴ Of this marriage there were five sons and four daughters. John, the eldest son, died in his youth; William was knighted by Charles the Second, and lived to an advanced age;⁵ Robert was married, but died about the age of forty without children; the two youngest, Richard and James, died in their infancy. The eldest daughter Elizabeth was married to Dr Henryson, an eminent physician in Edinburgh;⁶ but the other three, Margaret, Anabella, and Jane, died very young.⁷ The father was a decided

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¹ The first edition of his poems has the following title: "Poems, amorous, funerall, diuine, pastorall, in Sonnets, Songs, Sextains, Madrigals. By W. D. the author of the Teares on the Death of Mæliades." Edinburgh, printed by Andro Hart, 1616, 4to. Another edition, or the same edition with a new title, bears "Poems, by William Drvmmond of Hawthorne-denne. The second impression." Edinburgh, printed by Andro Hart, 1616, 4to.

² To this visit another poet of exquisite talents makes the following allusion:

Then will I dress once more the faded bower,
Where Jonson sat in Drummond's classic shade.

COLLINS'S Ode to John Home.

³ Gifford's *Memoirs of Jonson*, p. cxxx.—This charge has been sufficiently repelled by Sir Walter Scott in his *Provincial Antiquities of Scotland*, vol. ii. p. 133. See likewise Dr Drake's *Mornings in Spring*, vol. i. p. 286.

⁴ Hay's *Memoirs*, vol. ii. p. 105. MS. Adv. Lib.

⁵ Sir William Drummond is more celebrated for his jovialty than for his literature. See Dr Pennecuik's *Poems*, p. 49. 52. An honourable instance of his humanity is recorded in the *Memoirs of George Brysson*, p. 285.

⁶ This was probably Henry Henryson, M. D. of Elvingston, whose Latin version of the hundred and fourth psalm occurs in the *Octupla*. Edinb. 1696, 8vo. He is more commonly called Henderson, which is a corruption of the other name. Elizabeth, the heiress of her father Dr Henry Henderson of Elvington, was married to John Clerk of Pennecuik. (*Inquisitionum Abbreviatio*, vol. i. Haddington, 341.)

⁷ Douglas's *Baronage of Scotland*, p. 573, compared with Sage's *Life of Drummond*, p. vi.

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cavalier, and wielded his pen, though not his sword, in the king's service; and being reputed a malignant, he was exposed to some of the usual molestations of those unhappy times. The tragical fate of his sovereign is said to have hastened his own dissolution: we are informed by Bishop Sage that Drummond, being weakened by hard study and disease, was so overwhelmed with extreme grief and anguish that he died on the 4th of December 1649.¹ But as the king was executed on the 30th of January, an interval of more than ten months must have occurred between his death and that of his faithful subject; an interval so long as to render the biographer's inference somewhat questionable. He had nearly completed the sixty-fourth year of his age. His remains were interred in the church of Lasswade, which stands at the distance of about a mile from Hawthornden. He appears through life to have maintained a character of uniform respectability; uniting with his other qualities that of consistent piety, and blending morality with his devotion. His death was affectionately lamented by his friend Colonel Lauder of Hatton, who has left several other specimens of his poetical talents, and who was not the only Scottish soldier of this period that evinced his love of the Muses.

Drummond was evidently a man of superior talents and accomplishments. We are informed that he was familiarly acquainted with the best Greek and Latin authors: his long residence on the continent afforded him an excellent opportunity of acquiring a knowledge of the living languages; and he is said to have spoken French, Italian, and Spanish, as fluently as his native tongue. To his graver qualifications he added no mean proficiency in music; and he occasionally sought a relaxation from his studies by playing on the lute, "which he did to admiration." He seems to have devoted a considerable portion of his time to the invention or improvement of various instruments and machines, applicable to various purposes of peace or war. They are curiously enumerated, to the extent of sixteen, in a patent which he obtained in the year 1627, and which secured to him the sole right and property within the kingdom of Scotland for the space of twenty-one years.²

His literary productions exhibit considerable variety. His compositions in prose chiefly consist of the *Cypress Grove*, some political tracts, and the *History of the five Jameses*; a work which embraces the history of Scotland from 1423 to 1542.³ "The best of Drummond's prose works," says Mr Headley, "is his *Cypress Grove*, which, though quaint in its style, is worth reading for its vein of dignified morality." His history, which has alternately been the object of extravagant commendation and unsparing censure, cannot now be regarded as a work of much value or interest: the author's materials are not generally drawn from recondite sources, and his manner is too rhetorical. For the reputation which he still retains, Drummond is chiefly indebted, not to his historical, but to his poetical excellence; and, in the opinion of competent judges, he is entitled to a distinguished place among the English poets of that age. As few of his poems extend to a considerable length, his genius cannot be esti-

mated by the success of any great and continued effort; but notwithstanding the shortness of his flights, he generally soars on bright and steady wings. He is conspicuous for his delicate sensibility and warmth of fancy; and with these qualities, so essential in an amatory poet, he unites uncommon skill in versification. His taste seems in a great measure to have been formed upon the Italian model, nor are his compositions entirely free from Italian conceits; but he commonly maintains a degree of elegant simplicity to which few English poets of that age have attained.

The reputation which Drummond enjoyed during his life, appears to have suffered some diminution after his death. He was a gentleman, says Edward Phillips, "who imitating the Italian manner of versifying, vented his amours in sonnets, canzonets, and madrigals, and, to my thinking, in a style sufficiently smooth and delightful; and therefore why so utterly disregarded and layd aside at present, I leave to the more curious palats in poetry."⁴ After an interval of more than a century, the same complaint of unmerited neglect was repeated by Mr Headley. "Without ostentatious praise (which is always to be suspected), it is but truth to observe that many of his sonnets, those more especially which are divested of Italian conceits, resemble the best Greek epigrams in their best taste, in that exquisite delicacy of sentiment, and simplicity of expression, for which our language has no single term, but which is known to all classical readers by the word *ἀφελεια*. It is in vain we lament the fate of many of our poets, who have undeservedly fallen victims to a premature oblivion, when the finished productions of this man are little known and still less read."⁵

Drummond's sonnets form a very considerable proportion of his poetical works. The following four may be selected as a specimen of the entire collection; and they are here exhibited in modern orthography.

I know that all beneath the moon decays,
And what by mortals in this world is brought,
In Time's great periods shall return to nought;
That fairest states have fatal nights and days:
I know how all the Muse's heavenly lays,
With toil of spright which are so dearly bought,
As idle sounds, of few or none are sought,
And that nought lighter is than airy praise:
I know frail beauty like the purple flower,
To which one morn oft birth and death affords;
That love a jarring is of minds' accords,
When sense and will invassal reason's power.
Know what I list, this all cannot me move
But that, O me! I both must write and love.

With flaming horns the Bull now brings the year,
Melt do the horrid mountains' helms of snow,
The silver floods in pearly channels flow,
The late-bare woods green anadems do wear;
The nightingale, forgetting winter's woe,
Calls up the lazy morn her notes to hear;
Those flowers are spread which names of princes bear,
Some red, some azure, white, and golden grow.
Here lows a heifer, there bewailing strays
A harmless lamb, not far a stag rebounds;
The shepherds sing to grazing flocks sweet lays,
And all about the echoing air resounds.

¹ Sir Thomas Urquhart is said to have expired in a paroxysm of laughter, on hearing of the restoration of Charles the Second; a statement which is rendered sufficiently probable by the record of similar cases, and by the eccentric character of the individual. Aretæus, an ancient physician, specifies unextinguishable laughter as one of the causes of death: *γελως ἀσβεστος μεχρι θανατον*. (De Causis et Signis Morborum, lib. i. p. 35. edit. Boerhaave. Lugd. Bat. 1735, fol.) And other ancient writers have mentioned the names of different persons who died of excessive joy. (Valerius Maximus, lib. ix. cap. xii. Plinii Hist. Nat. lib. vii. cap. liii.) According to the common account, Sophocles was of this number.

² Drummond's Works, p. 235. Edinb. 1711, fol.

³ Of his *History of Scotland*, the first edition is that of London, 1655, fol. The introduction was written by Mr Hall of Gray's Inn. There are other three editions.

⁴ Phillips's *Theatrum Poetarum*, or compleat Collection of the Poets, part ii. p. 192. Lond. 1675, 12mo.

⁵ Headley's *Biographical Sketches* (p. xlv.) prefixed to *Select Beauties of Ancient English Poetry*. Lond. 1787, 2 vols. 8vo.

Drummond.

Drum-
mond.

Hills, dales, woods, floods, and every thing doth change,
But she in rigour, I in love am strange.

Trust not, sweet soul, those curled waves of gold,
With gentle tides which on your temples flow,
Nor temples spread with flakes of virgin snow,
Nor snow of cheeks with Tyrian grain enroll'd;
Trust not those shining lights which wrought my woe,
When first I did their burning rays behold,
Nor voice, whose sounds more strange effects do show
Than of the Thracian harper have been told.
Look to this dying lily, fading rose,
Dark hyacinth, of late whose blushing beams
Made all the neighbouring herbs and grass rejoice,
And think how little is 'twixt life's extremes.
The cruel tyrant that did kill those flowers,
Shall once, aye me! not spare that spring of yours.

What doth it serve to see sun's burning face,
And skies enamell'd with both the Indies' gold,
Or moon at night in jetty chariot rolled,
And all the glory of that starry place?
What doth it serve earth's beauties to behold,
The mountains' pride, the meadows' flowing grace,
The stately comeliness of forests old,
The sport of floods, which would themselves embrace?
What doth it serve to hear the Sylvens' songs,
The wanton merle, the nightingale's sad strains,
Which in dark shades seem to deplore my wrongs?
For what doth serve all that this world contains,
Sith she, for whom those once to me were dear,
No part of them can have now with me here?

To some of his compositions, which he has described as songs, this title is by no means applicable; it is neither applicable to the vein of poetry, nor to the measure of the verse. One striking poem, which he entitles a song, is written in heroic couplets, and contains such passages as this:

And tell me, thou who dost so much admire
This little vapour, smoke, this spark or fire,
Which life is call'd, what doth it thee bequeath
But some few years which birth draws out to death?
Which if thou paragon with lustres run,
And them whose career is but now begun,
In day's great vast they shall far less appear,
Than with the sea when matched is a tear.
But why would'st thou here longer wish to be?
One year doth serve all nature's pomp to see,
Nay, even one day and night: this moon, that sun,
Those lesser fires about this round which run,
Be but the same which, under Saturn's reign,
Did the serpentine seasons interchain.
How oft doth life grow less by living long,
And what excelleth but what dieth young?¹

His collection of sacred verses, which he entitles *Flowres of Sion*,² contain much poetical imagery and expression. Some of the topics cannot be very safely approached by a poet, who must place his chief reliance on the exercise of his fancy; and the subsequent lines of this writer may sometimes occur to the recollection of his reader:

Who would this Eden force with wit or sense,
A cherubim shall find to bar him thence.

One of the longest poems in this collection, entitled a Hymne on the fairest Faire, contains the following among many other striking passages:

Ah! as a pilgrim who the Alps doth pass,
Or Atlas' temples crown'd with winter's glass,
The airy Caucasus, the Apennine,
Pyrenes cliffs where sun doth never shine,
When he some heaps of hills hath over-went,
Begins to think on rest, his journey spent,
Till, mounting some tall mountain, he doth find
More heights before him than he left behind:
With halting pace so while I would me raise
To the unbounded circuits of thy praise,
Some part of way I thought to have o'er-run,
But now I see how scarce I have begun,
With wonders new my spirits range possest,
And wand'ring wayless in a maze them rest.

It has been suggested by Mr Headley that one would be induced to suppose Pope must have remembered these lines when he wrote a well-known passage in his *Essay on Criticism*. The subsequent couplet, which occurs in the same hymn, is remarkable for its energetic simplicity:

Uncomprehensible by reachless height,
And unperceived by excessive light.

Another poem of considerable length he entitles the *Shadow of the Judgment*. It is left in an unfinished state, and is not included in the collection published under the direction of Sir John Scot;³ but it nevertheless contains many passages worthy of the author's reputation. An elegant critic has remarked that the following verses, describing God moved to wrath, are in Milton's manner:

So seeing earth, of angels once the inn,
Mansion of saints, defloured all by sin,
And quite confus'd by wretches here beneath,
The world's great sovereign moved was to wrath.
Thrice did he rouse himself, thrice from his face
Flames sparkle did throughout the heavenly place:
The stars, though fixed, in their rounds did quake,
The earth, and earth-embracing sea did shake:
Carmel and Hæmus felt it, Athos' tops
Affrighted shrunk, and near the Ethiops
Atlas, the Pyrenees, the Apennine,
And lofty Grampius, which with snow doth shine.
Then to the synod of the sprights he swore,
Man's care should end, and time should be no more.

Drummond's poem in commemoration of Prince Henry⁴ commences in a strain somewhat bombastic, but it contains some elegant and striking passages. The subsequent lines exhibit a very favourable specimen of his versification; and it is proper to recollect that the poem was printed so early as the year 1613. He describes the lamented youth as rejoicing to look down to the azure bars of heaven,

And in their turning temples to behold,
In silver robe the moon, the sun in gold,
Like young eye-speaking lovers in a dance,
With majesty by turns retire, advance.
Thou wonderest earth to see hang like a ball,
Clos'd in the ghastly cloister of this all;

¹ Ον οί βροί φιλονεικούν ἀποθνήσκου νεός.

MENANDRI Fragmenta, p. 48. edit. Meineke.

² *Flowres of Sion*. By William Drummond of Hawthorne-denne. To which is adjoyned his *Cypresse Groue*. 1623, 4to. Eden-bourgh, printed by Iohn Hart, 1630, 4to.

³ Poems by that most famous wit Mr William Drummond of Hawthornden. Lond. 1656, 8vo. The editor was Edward Phillips, the nephew of Milton. The same edition was exhibited under a new and fantastic title, with the date of 1659. A more extensive collection of his poems is to be found in the *Works of William Drummond of Hawthornden*. Edinb. 1711, fol. Bishop Sage's life of the author is prefixed to this publication. But the most complete, as well as the most elegant edition was printed under the superintendence of Mr Maitland: "The Poems of William Drummond of Hawthornden." Edinb. 1832, 4to. The book however is not published: it was the splendid contribution of William Macdowall, Esq. of Garthland to the Maitland Club.

⁴ *Teares on the Death of Mœliades*. Edinbvrgh, printed by Andro Hart, 1613, 4to. His two sonnets and epitaph, which appear in this publication, are likewise inserted in the "Marsolevm, or choisest Flowres of the Epitaphs, written on the Death of the neuer-too-much lamented Prince Henrie." Edinb. 1613, 4to. A third edition of the "Teares on the Death of Mœliades" soon followed. Edinb. 1614, 4to. The second we have not seen.

Drum-
mond.

And that poor men should prove so madly fond
To toss themselves for a small foot of ground;
Nay, that they even dare brave the powers above,
From this base stage of chance that cannot move.
All worldly pomp and pride thou seest arise
Like smoke, that scatt'eth in the empty skies.
Other hills and forests, other sumptuous tow'rs,
Amaz'd thou find'st excelling our poor bow'rs;
Courts void of flattery, of malice minds,
Pleasure which lasts, not such as reason blinds.

Forth Feasting, a poem written in the year 1617 on the king's visit to his native country,¹ may be considered as his best performance; it abounds with poetical imagery, and the versification possesses uncommon terseness and harmony. In all poems of the same age and denomination, the reader must necessarily expect a certain sprinkling of mythology; this is a prevailing vice, an endemic disease, among the poets of that period; but Forth Feasting is enlivened by an elegant vein of fancy, and contains various passages of distinguished felicity. In the following nervous lines, he pays a warm and not unmerited compliment to the monarch's love of peace:

Now, where the wounded knight his life did bleed,
The wanton swain sits piping on a reed,
And where the cannon did Jove's thunder scorn,
The gaudy huntsman winds his shrill-tun'd horn;
Her green locks Ceres without fear doth dye,
The pilgrim safely in the shade doth lie,
Both Pan and Pales careless keep their flocks,
Seas have no dangers save the winds and rocks:
Thou art this isle's Palladium, neither can,
While thou art kept, it be o'erthrown by man.
Let others boast of blood and spoils of foes,
Fierce rapines, murders, Iliads of woes,
Of hated pomp, and trophies reared fair,
Gore-spangled ensigns streaming in the air,
Count how they make the Scythian them adore,
The Gaditan, the soldier of Aurore;
Unhappy vauentry! to enlarge their bounds,
Which charge themselves with cares, their friends with wounds,
Which have no law to their ambitious will,
But, man plagues, born are human blood to spill:
Thou a true victor art, sent from above,
What others strain by force to gain by love;
World-wand'ring Fame this praise to thee imparts,
To be the only monarch of all hearts.

When the successor of this king visited his northern dominions in the year 1633, Drummond contributed the verses for the pageants which welcomed his arrival in Edinburgh.² These verses, although they do not exhibit passages equal to those which we have lately examined, are not destitute of merit. Of the frequent compression and harmony of his couplets, every reader must be sufficiently aware; and the excellence of his versification has been highly extolled by an English critic. Waller and Denham are often regarded as the great improvers of a mode of versification which was carried to greater perfection by Dryden; but the Tears on the Death of Mæliades, and Forth Feasting, were composed several years before either of those poets had reached the age of manhood.³ (x.)

DRUMMOND, *Sir William*, of Logie-Almond, a distin-

guished scholar, acute philosopher, and accomplished writer, died at Rome, of a lingering and painful disease, on the 29th of March 1828. The date of his birth we have not been able to ascertain, and consequently cannot pretend to determine his age at the time of his decease.

He seems to have been early ambitious of literary distinction, and in 1794 he published *A Review of the Government of Sparta and Athens*, large 8vo; a work which, though not destitute of merit, and exhibiting considerable traces of a vigorous mind, yet gave no promise of that bold spirit of speculation for which its author was afterwards so much distinguished. At the close of the year 1795, he was returned to parliament for the borough of St Mawes, in the representation of which a vacancy had occurred; and in the two following parliaments, which met respectively in 1796 and 1801, he sat for the town of Lostwithiel. At the time of his second election he had been appointed envoy-extraordinary to the court of Naples.

In the year 1798, he published *The Satires of Persius Translated*, 8vo, which happened to appear about the same time with the rival translation of the Roman satirist by Mr Gifford, author of the Baviad and Mæviad, and afterwards editor of the *Quarterly Review*. This translation alone would have been sufficient to fix his reputation as an accomplished classical scholar; and, in point of fact, it has been much admired by all who are competent to appreciate the difficulty of the task which he so successfully performed. It would not be easy, indeed, to overrate the skill with which the niceties of Persius have been discriminated, or the felicity with which the idiomatic peculiarities of that difficult author have been converted into equivalent forms of expression. Drummond's versification is easy, graceful, and precise; and though it wants the piquancy of allusion, the congenial bitterness of spirit, and the occasional point and concentration, which impart so strong a zest to the translation of Mr Gifford, it is yet distinguished for greater freedom and equal fidelity, two things which Drummond has shown that it is not impossible to reconcile.

In the year 1801, Mr Drummond being then ambassador to the Ottoman Porte, was honoured with the order of the Crescent, which was confirmed by license, in the London Gazette, dated the 8th of September 1803.

In 1805 Sir William published his *Academical Questions*, in 4to, and thereby greatly extended his fame as an author. Hitherto he had appeared only in the character of an elegant and accomplished scholar; but in this work he boldly entered the domain of philosophy, and in a free and fearless spirit attacked every species of dogmatism, whether consecrated by time, or sustained by authority, exposing the weakness of the human understanding, and mortifying the pride of pretended wisdom, by a collection of what appear to be insoluble cases and indeterminate problems. In this work, however, it is only the task of demolition which he proposes to accomplish; and it must be owned that he has spread abroad the rubbish and scattered the dust of philosophical systems in a somewhat ap-

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¹ Forth Feasting. A Panegyricke to the Kings most excellent Majestie. Edinbvrgh, printed by Andro Hart, 1617, 4to.—This poem occurs in the *Muses Welcome*, p. 25.

² Drummond's verses appeared in a publication entitled "The Entertainment of the high and mighty Monarch Charles, King of Great Britaine, France, and Ireland, into his auncient and royall Citie of Edinbvrgh, the fifteenth of Iune 1633." Printed at Edinbvrgh by Iohn Wreittoun, 1633, 4to. The last work which he himself is known to have published bears the following title: "To the Exequies of the Honovrable Sr Antonye Alexander, Knight, &c. A pastorall Elegie." Edinbvrgh, printed in King James his College, by George Anderson, 1638, 4to. Mr Maitland has reprinted the *Polemio-Middinia* from the earliest edition that has been traced. Edinb. 1684, 4to.

³ Neve's *Cursory Remarks* on some of the Ancient English Poets, particularly Milton, p. 49. Lond. 1789, 8vo.—With respect to the supposed merit of Waller and Denham as improvers of English versification, the reader may consult Mr Crowe's *Treatise on English Versification*, p. 166. Lond. 1827, 8vo.

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palling manner. "The author of *Academical Questions*," says the able critic of the work in the *Edinburgh Review*, "is indubitably a person of great reading, and much natural acuteness; but he has taken too wide a range, and indulged somewhat too much in a vein of controversial declamation. He often seems to think more of demolishing his antagonist than of enlightening his reader; and sometimes appears to enlarge upon a topic as much for the display of his eloquence as for the support of his reasoning. By frequent reference to the Greek writers, and continual allusions to the usages of antiquity, he expected perhaps to seduce the scholars of the South into metaphysical investigations, and to engage the attention of polite readers by a certain vivacity and polish in the turn of his expression. If this was his view, however, he certainly ought not to have plunged at first into the great gulf of substance and entity." (*Edinburgh Review*, vol. vii. p. 185.) To these observations, however, it is proper to add, that the author avowedly reserved the full exposition of his own theory for a subsequent volume, though in point of fact it never appeared; and that in this preliminary publication he conceived himself to be only clearing out the foundation on which it was his intention afterwards to build.

In the year 1810, Sir William Drummond, in conjunction with Robert Walpole, Esq. published *Herculanensia*, in 4to, containing archæological and philological dissertations, and a copy of a manuscript found amongst the ruins of Herculaneum; and in 1811 appeared an *Essay on a Punic Inscription found in the Isle of Malta*, royal 8vo; both works of great merit and erudition. Sir William was also an occasional, if not a frequent, contributor to the *Classical Journal*; in which his papers on subjects of antiquity, particularly the zodiac of Denderah, which occupied without exhausting his ingenuity, attracted the general admiration of the learned, if not always on account of their soundness, at least by reason of the acuteness and originality they display, and the resources of learning which the author had always at command for the illustration of his peculiar views. About this time, Sir William Drummond, whose residence at Constantinople had turned his attention to oriental literature, sacred as well as profane, consigned the fruits of his researches and investigations into the historical books of the Old Testament, in his *Ædipus Judaicus*. This singular work was never published, having been printed solely for distribution amongst the author's friends and acquaintance; but as he had caused a considerable impression to be struck off, copies of it soon found their way into the hands of persons connected with the periodical press, and those of others; and, as might have been expected, it was most fiercely attacked. The first onset was made by a churchman of the name of D'Oyly, in *Letters to the Right Hon. Sir William Drummond, in Defence of particular Passages of the Old Testament against his late work entitled "Ædipus Judaicus;"* and the attack was renewed in the *Quarterly Review*, with equal vigour and ability. Whether it was altogether fair thus openly to stigmatize a book which had never been published, we shall not stop to inquire; more especially as the principal cause of regret is, not that it was severely criticised, but that it was ever written, far less printed. In the controversy which thus arose, however, Sir William was overmatched, both in science and in Hebrew, with which D'Oyly and the Reviewer evinced a most intimate acquaintance; and although his reply displayed much ingenuity, no skill could evade, far less destroy, the force of some of the criticisms. The truth is, the allegorical theory which he undertook to establish was taken at second hand from the work of Dupuis; and although the author, notwithstanding all the errors charged against him, brought great stores of learning and erudition to bear upon it, yet

the absurdities to which it leads are so glaring, and the consequences which follow from it are so pernicious, that it is surprising Sir William Drummond should not have foreseen the one, or been prudent enough not to hazard the other. The preface, too, though beautifully written, contains observations which nothing can excuse, and irreverences so gross as even to shock persons the least scrupulous about subjects of religion. The profane joke about veal cutlets is worthy only of Mr Thomas Paine, and fit to appear in no work where the ordinary humanities of taste and reason are duly observed.

In 1818 Sir William Drummond published, experimentally we believe, the first part of a poem entitled *Odin*, 4to, the object of which was to embody in verse some of the more striking features of the Scandinavian mythology. The poem, however, did not succeed in attracting public attention, which was then almost exclusively fixed on some of the great masters of song, whose deep voice of inspiration filled the land; and although it contained passages of very considerable power and beauty, it fell into almost immediate oblivion.

But the work on which the reputation of Sir William Drummond as a scholar and antiquary must chiefly rest, is his *Origines, or Remarks on the Origin of several Empires, States, and Cities*, in 3 vols. 8vo. The first volume, embracing the origin of the Babylonian, the Assyrian, and the Iranian empires, appeared in 1824; the second, which is wholly devoted to the subject of Egypt, including the modern discoveries in hieroglyphics, came out in 1825; and the third, which treats of the Phœnicians and Arabia, was published in 1826. It would be exceedingly difficult, by a general statement, or by critical observations apart from details, to convey an accurate idea of the real character and merits of this work; which, with much that is strained, exaggerated, or defective, to say nothing of errors into which the author is sometimes betrayed by the excessive refinements of an ever active ingenuity, is in several respects one of the most remarkable productions of modern times. A principal feature of the *Origines*, though certainly the least obtrusive, is, that here the author labours quietly to build up and fortify the authority of the historical books of the Old Testament, which, in the *Ædipus Judaicus*, he had (probably without intending it) contributed to impair, if not to pull down: whilst by concentrating, as it were, into one focus the various scattered lights of tradition, history, philosophy, science, etymology, and archæology, he has contrived to illuminate many of the darkest passages in the records of the ancient world; to dispel no inconsiderable portion of the obscurity which overshadowed the origin and annals of the great empires of antiquity; and, even in the merest archæological discussions, to interweave incidental illustrations, alike curious in themselves, and valuable to the scholar, the theologian, and the antiquary. Upon this work, therefore, as on a fixed and enduring pedestal, the fame of Drummond as a scholar must in a great measure rest. Besides its other great and singular merits, it has that which indeed is peculiar to almost all Drummond's works, of being written in a pure, chaste, classical style, full of vivacity and vigour, and sometimes even rising into a rich and lofty strain of eloquence. The dialogue between Neomathes and Philothoth, in the second volume, where the one impugns and the other defends the astronomical and mathematical skill of the ancient Egyptians, may be instanced as a specimen of the grace, elegance, and force of Drummond's style, when it flows in a continuous stream, unbroken by the projecting corners and edges of a hard and rugged erudition.

Sir William Drummond's appreciation of the modern discoveries in hieroglyphics (a subject to which three consecutive chapters of the second volume are devoted)

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is, in general, sound and discriminating; and he foresaw sooner than almost any one else, that the powers of the phonetic alphabet, as an instrument of discovery, would be found to have been greatly over-rated. In a letter, dated Naples, 27th April 1827, and addressed to the author of this imperfect notice, he very distinctly shows how fully he had estimated the difficulty which M. Champollion had overlooked, and which now appears to be nearly, if not altogether insuperable. "That M. Champollion's system is accurate to a certain extent," says he, "I admit; and his discoveries do him great honour. Whether he be right in all the details of his system is another question. He establishes the existence of a very great number (I forget the precise number) of phonetic hieroglyphs;¹ and to these, he says, are to be traced all the characters of the running hand, which he reads with so much ease. Now I cannot help observing, that where there are so many signs to represent each alphabetical letter, and where consequently there must have been various contractions for each of these signs in the running hand, the task of learning all these contractions without the aid of a master, and of accurately referring them to their prototypes, must be immense. In Sanscrit there are fifty-two letters, and yet there are above eight hundred contractions. To refer these Sanscrit contractions to their original letters is not always very easy; but the difficulty in Egyptian must have been much greater, in which language the phonetic characters, and consequently the contractions, are far more numerous." Here we have the germ of those principles which, developed and applied by Klaproth to the values of characters as set down by M. Champollion, have made terrible havoc of his discoveries, and left him at last little more than what he took without acknowledgment from Dr Young.

Of Sir William Drummond in his public capacity we are not prepared to speak with any degree of confidence, having little knowledge of his services as a diplomatist, or of his capabilities for acting in that character. The habit of his mind was a cautious or rather tentative boldness, accompanied with perseverance, yet tempered with a conciliating blandness of disposition, and an amenity of manners, native to his character; and it is to be presumed that this prevailing tendency showed itself in the conduct of affairs, as well as in abstract or speculative pursuits. In 1808, we find him, whilst resident at the court of Palermo, ostensibly embarked in a scheme for securing the regency of Spain, which had then just risen in arms to throw off the yoke of France, to Prince Leopold of Sicily. As might have been expected, the project misgave at the very commencement, and Sir William Drummond has not escaped censure for the part he had in it. "Sir William Drummond, the British envoy at Palermo, Mr Viale, and the Duke of Orleans," says Colonel Napier, "were the ostensible contrivers of this notable scheme, by which, if it had succeeded, a small party in a local junta (that of Seville) would have appointed a regency for Spain, paved the way for altering the laws of succession in that country, established their own sway over the other juntas, and created interminable jealousy between England, Portugal, and Spain; but with whom the plan originated does not very clearly appear. Sir William Drummond's representations induced Sir Alexander Ball to provide the ship of war, nominally for the conveyance of the Duke of Orleans [now king of the French, who had made no secret of his intention to negotiate for the regency of Spain], but in reality for Prince Leopold, with whose intended voyage Sir Alex-

ander does not appear to have been made acquainted. Druses. That the prince should have desired to be regent of Spain was natural; but that he should have been conveyed to Gibraltar in a British ship of the line, when the English government disapproved of his pretensions, was really curious. Sir William Drummond could scarcely have proceeded such lengths in an affair of so great consequence, without secret instructions from some member of his own government; yet Lord Castlereagh expressed unqualified approbation of Sir Hew Dalrymple's decisive conduct upon the occasion." (Napier's *History of the Peninsular War*, vol. i. p. 177.) In politics Sir William Drummond appears to have known his ground well, and to have given entire satisfaction to the governments which employed him, at periods of no ordinary difficulty, in transacting affairs of the greatest importance.

Such is an imperfect outline of the literary and political character of this distinguished person. In private life he was a man of modest, retiring, unobtrusive manners, perfectly unconscious that he differed from or had any claims to distinction superior to the most ordinary and commonplace person who fell in his way. Throughout his whole life he was a close and assiduous student, often preferring the company of his books to the promiscuous and frivolous intercourse of company; and hence he was sometimes considered as eccentric, if not cold, distant, and haughty, by those who neither knew nor could sympathise with the habits which are gradually formed by a studious and contemplative life; habits which continue unconsciously to grow upon men whose days and nights are devoted to the pursuit of knowledge. But he was, nevertheless, one of the kindest, mildest, and most generous and humane men that ever existed. To his tenants and dependents he was indulgent even to the injury of his own private fortune; to his friends he was most stedfastly and fervently devoted. In him rising merit was always sure to find a ready and active patron; and not a few individuals have owed their establishment and success in life to the circumstance of having attracted his notice, or of being pointed out to him as deserving of support or encouragement. Latterly, owing to the precarious state of his health, which made it necessary for him to resort to a warmer climate, he resided almost constantly abroad; chiefly, we believe, at Naples, where he continued to indulge in those learned pursuits which formed the main solace and delight of his life. (A.)

DRUNKENNESS, or INTOXICATION, a well-known vice, the consequence of an excessive use of spirituous liquors, wines, or drugs. Drunkenness is gradually produced, and several distinct stages may be traced in its progress. The sensations experienced in the earlier stages, or the state of incipient intoxication, are peculiarly pleasurable. The mind becomes unusually excited; a soft serenity steals over it, inducing a spirit of universal contentment; gaiety and warmth kindle at the heart, and images of beauty expand before the imagination. In this state, before consciousness is attacked, or the sensorium affected, some of the faculties of the soul act with greater liveliness and vigour, and the feelings of strength and courage are increased. In a short while the sense of propriety is lost, the soul begins to open itself and pour forth its secrets, displaying all the peculiarities of temper, good or bad. Gradually the scene thickens, and consciousness becomes still more weakened. Reason vacates her throne, and grotesque conceptions crowd upon the fancy. Dizziness attacks the brain, and surrounding objects, seeming to lose their balance,

¹ About a hundred and forty; whilst, even by the lowest estimate, the total number of hieroglyphs on the monuments exceeds eight hundred.

Drunken-
ness.

Into strange vagaries fall,
As they would dance.

The drunkard begins to feel the earth unsteady beneath his feet, his sense of equilibrium gives way, and total insensibility succeeds, in which a state of stupor, wild dreams, and horror, strongly contrasts with that of previous excitement. Different individuals are differently affected by the inebriating liquid. The state of the passions at the period of indulging in strong liquors also operates powerfully in modifying its effects. Persons under sentence of death, and immediately before execution, have been known to swallow with impunity draughts of the strongest alcohol, which, under other circumstances, would have rendered them senseless. Hence the remarkable propriety of the language put into the mouth of Lady Macbeth previously to the contemplated murder, when, alluding to the manner in which she had "drugged the possets" of the grooms, she says, "that which hath made them drunk hath made me bold." In some persons constitutional moroseness and melancholy are dispelled; in others their habitual gloom is aggravated. Cases of the latter description, however, are by no means so numerous as those of the former, and the general effect of indulgence in "thick potations" is to dispel the clouds of care, at least for the time being. But the re-action which eventually follows over-excitement serves to deepen the darkness, and, by a dispensation of retributive justice, to inflict certain punishment for the previous delinquency. Drunkards who are of a sanguineous temperament are most intensely excited by the use of strong liquors.

It is unnecessary to enumerate the various inebriating agents, which, as well as temperament, influence the nature of the intoxication produced. Thus ebriety from ardent spirits differs from that generated by malt liquors. Besides alcohol, which is the intoxicating principle in all liquors, there are various substances taken, both in the solid and fluid state, which induce intoxication. The most common and remarkable are opium and nitrous oxide gas. The former, it is well known, is in extensive use for this purpose in the East, but the latter has not yet been employed out of the laboratory of the chemist. The effects produced by this gas are described by the discoverer, Sir Humphry Davy, and others who have experienced them, as very delightful, and similar to those felt during the earlier stages of intoxication from wine, but of a purer and more ethereal nature.

Amongst the physiological effects of drunkenness are vertigo, double vision, staggering and stammering, heat and flushing, ringing in the ears, and other analogous affections. Vertigo, though partly produced by the ocular delusions under which the drunkard labours, seems principally to arise from the close sympathy which subsists between the brain and the nerves of the stomach. Double vision is readily accounted for by the influence of increased circulation in the brain upon the nerves of sight. Staggering and stammering may likewise be explained by the disordered state of the nervous system. Heat and flushing result from the strong determination of blood to the surface of the body, and ringing in the ears particularly from the throbbing of the internal carotid arteries, which run in the immediate neighbourhood of the ear. The mental pleasure arising from intoxication is not so easily explained, though the primary cause no doubt is physical or rather nervous excitement gradually superinduced, and thus stimulating both the imagination and the passions. The evil consequences of drinking, both in a physical and moral point of view, are numerous and distressing. On the unhappy victim of this propensity a long train of bodily diseases and infirmities are entailed. The liver, stomach, brain, kidneys, indeed all the functions

of the body, are seriously impaired by the practice; and in this state the frame is not only more liable to attacks of disease, but when they do come they are likely to exhibit tenfold inveteracy. Thus life is either suddenly shortened, or protracted into a long disease. Death itself is frequently an immediate consequence of over indulgence. We shall not attempt a classification of the bodily infirmities and pernicious effects which drunkenness produces; but we may mention madness, and spontaneous combustion of the body, as belonging to the number. The former is by no means a rare occurrence, and there are well authenticated cases of the latter. Drunkenness in a judicial point of view is not punishable by our laws; but acts of violence committed under its influence are held to be aggravated rather than otherwise; nor can the accused allege it as an extenuation of the crime of which he has been guilty. In proof of this it may be stated, that a bond signed in a fit of intoxication holds good in law, and is perfectly binding, unless it can be shown that the person who signed it was inebriated by the collusion or contrivance of those to whom the bond was given.

Drunkenness has been known from the earliest ages. Wherever the grape flourished inebriation soon made its appearance. It has greatly varied at different times and amongst different nations. There can be no doubt that in a rude, uncivilized state of society, it prevails to the greatest extent, and assumes the most revolting forms. It is also found to exist more extensively in northern than in southern latitudes, owing no doubt to the difference of climate. As society is refined, the vice certainly diminishes amongst the higher orders, although amongst those in the lower ranks it is still found to exist to a fearful extent. For checking this demoralizing practice various moral engines have been set to work, but without a success commensurate with the philanthropy of the design or the importance to society of the anticipated results.

DRUSES, an independent people of Palestine, of warlike habits, who inhabit the mountains of Libanus, Anti-Libanus, and all the coast from Gibail to Saide, and east as far as Balbec. There are various conjectures concerning the origin of this singular race; the most rational of which is, that they were originally a persecuted sect of Mahommedans, who, flying from oppression, took refuge, about the commencement of the eleventh century, amongst the mountains of Lebanon, and there formed an independent society.

The unity of the Mahommedan faith was at a very early period broken by contending sectaries; and, according to the full and accurate details of Volney, from whom the following account is chiefly compiled, Egypt, under the influence of these delusions, became, in the reign of the third caliph of the race of the Fatimites, and in the year of the Hegira 386 (A. D. 996), the theatre of the most extravagant enthusiasm and absurdity ever perhaps recorded in history. This prince, called Hakem-b'amr-ellah, was remarkable for his heresies and fanatical zeal. He caused the first caliphs, the companions of Mahommed, to be cursed in the mosques, and afterwards revoked the anathema; he compelled the Jews and Christians to abjure their religion, and then permitted them to resume it; he forbade the pilgrimage to Mecca, fasting, and the five prayers; and at length carried his madness so far as to desire to pass for God himself. This impious pretension was supported by a false prophet, who came from Persia into Egypt, and who, to ingratiate himself with Hakem, maintained that this caliph was God himself incarnate. But unluckily for the prophet, his new god had not the power to protect him from the fury of his enemies, who slew him in a tumult almost in the arms of the caliph, who was himself massacred soon afterwards on Mount

Druses.

Druses. Mokhattam, where, as he said, he had held conversation with angels.

The death of these two chiefs did not stop the progress of their opinions. A disciple of Mohammed-ben-Ismael, named Hamzu-ben-Ahmud, propagated them with indefatigable zeal in Egypt, in Palestine, and along the coast of Syria, as far as Sidon and Berytus. But his proselytes being persecuted by the sect in power, took refuge in the mountains of Lebanon, where they were better able to defend themselves; and shortly after this era we find them established there, and forming an independent society.

The difference of their opinions naturally disposes them to be enemies, but the urgent interest of their common safety forces them to allow mutual toleration; and they have always appeared united, and have jointly opposed, at different times, the Crusaders, the sultans of Aleppo, the Mamelukes, and the Ottomans. The conquest of Syria by the latter made no change in their situation. Selim I. on his return from Egypt, meditating no less than the conquest of Europe, disdained to waste his time before the rocks of Lebanon. Soliman II. his successor, incessantly engaged in important wars, either with the knights of Rhodes, the Persians, the kingdom of Yemen, the Hungarians, the Germans, or the emperor Charles V. had no time to think of the Druses. Emboldened by this inattention, and not content with their own independence, they frequently descended from their mountains to pillage the Turks. The pashas in vain attempted to repel these inroads; for their troops were invariably routed or repulsed. But about the year 1588 they were at last subdued by Amurath III., to whom they became tributary, and under whose powerful sway the anarchy by which the country was distracted under its different chiefs was put an end to; and one head or chief was established, who was invested with the executive power, and who was made liable to the sultan for the stipulated tribute, which he was to collect as he best could from the people. The whole power and resources of the country being by this conquest or revolution concentrated under one head, the Druses were engaged in continual warfare and in marauding hostilities with the Turks; and towards the middle of the seventeenth century they had attained to the height of their power under the celebrated emir Fakir-el-din or Fakardin. This chief extended his conquests, and at length became so formidable that he excited the terror of the sultan, who resolved to make an effort for his destruction. To avert the threatening storm he embarked for Italy to solicit succours from the court of the Medici, at Florence, where he remained for nine years. On his return he found every thing prosperous under the wise government of his son Ali. But this prince was afterwards defeated in a battle with the Turks; and Fakir-el-din himself being compelled to take refuge in the mountains, was betrayed into the hands of the Turks by his companions, and by the orders of Amurath he was strangled at Constantinople in the year 1631.

After the death of Fakir-el-din, the posterity of that prince still continued in possession of the government, though at the pleasure, and as vassals, of the Porte. But as this family failed in the male line at the beginning of the last century, the authority devolved, by the election of the scheiks, on the house of Shelah. The only emir of that house whose name deserves to be preserved, is Melhem, who reigned from 1740 to 1759; in which interval he retrieved the losses of the Druses, and restored them to that consequence which they had lost by the defeat of Fakir-el-din. Towards the end of his life, about the year 1754, Melhem, wearied with the cares of government, abdicated his authority, to live in religious retirement, after

the manner of the Okkals; but the troubles which succeeded forced him once more to resume the reins of government, which he held till 1759, when he died universally regretted.

He left three sons, minors, the eldest of whom ought, according to the custom of the country, to have succeeded him; but being only eleven years of age, the authority devolved on his uncle Mansour, agreeably to a law very general in Asia, which provides that the people shall be governed by a sovereign who has arrived at years of maturity. The young prince was but little fitted to maintain his pretensions; but a Maronite, named Sad-el-kouri, to whom Melhem had intrusted his education, took this upon himself. Aspiring to see his pupil a powerful prince, that he might himself become a powerful vizir, he made every exertion to advance his fortune; and accordingly entered into a great many plots and intrigues, in which he succeeded by means of an emir of the name of Yussuf in subverting his authority. We have no exact or accurate information of the internal state of this country, or of the domestic agitations and wars by which it has since been distracted. Nor would the detail of these petty wars, however ample or correct, possess any peculiar interest. The country is ruled by an emir, who is considered as the vassal of the Turks.

In their religion the Druses have very peculiar tenets and observances. They practise neither circumcision, nor prayers, nor fasting; they observe neither festivals nor prohibitions. They drink wine, eat pork, and allow marriage between brothers and sisters, though not between fathers and children. From this we may conclude, with reason, that the Druses have no religion; yet one class of them must be excepted, whose religious customs are very peculiar. Those who compose it are to the rest of the nation what the initiated were to the profane. They assume the name of *Okkals*, or spiritualists, and bestow on the vulgar the epithet of *Djahel*, or ignorant. They have various degrees of initiation, the highest orders of which require celibacy. These are distinguished by the white turban, which they affect to wear as a symbol of their purity; and so proud are they of this supposed purity, that they think themselves sullied by even touching a profane person. If you eat out of their plate, or drink out of their cup, they break them; and hence the custom, so general in this country, of using vases with a sort of cock, which may be drank out of without touching them with the lips. All their practices are enveloped in mysteries. Their oratories stand alone or detached, and are constantly situated on eminences; in these they hold their secret assemblies, to which women are admitted. It is believed that they perform ceremonies there in presence of a small statue resembling an ox or a calf; and hence some have pretended to prove that they are descended from the Samaritans. But besides that the fact is not well ascertained, the worship of the ox may be deduced from other sources.

The rest of the Druses, strangers to this spirit, are wholly indifferent about religious matters. The Christians who live in their country pretend that several of them believe in the metempsychosis, and that others worship the sun, moon, and stars. All this is possible; for every one, left to his own fancy, follows the opinion which pleases him most; and these opinions are those which present themselves most naturally to unenlightened minds. When among the Turks, they affect the exterior of Mahomedans, frequent the mosques, and perform their ablutions and prayers. Among the Maronites, they accompany them to church, and, like them, make use of holy water. Many of them, importuned by the missionaries, suffer themselves to be baptized; and if solicited by the

Druses. Turks, receive circumcision, and conclude by dying neither Christians nor Mahomedans. But they are not so indifferent in matters of civil policy.

The Druses may be divided into two classes: the common people; and the people of eminence and property, distinguished by the title of scheiks and emirs, or descendants of princes. The greater part are cultivators, either as farmers or proprietors; and every man lives on his inheritance, improving his mulberry trees and vineyards. In some districts they grow tobacco, cotton, and some grain; but the quantity of these is inconsiderable. It appears that at first all the lands were, as formerly in Europe, in the hands of a small number of families. But in order to render them productive, the great proprietors were forced to sell part of them, and let leases; which subdivision has become the chief source of the power of the state, by multiplying the number of persons interested in the public welfare. There still exist, however, some traces of the original inequality, which even at this day produces pernicious effects. The great property possessed by some families gives them too much influence in all the measures of the nation; and their private interests have too great weight in every public transaction. Their recent history affords sufficient proofs of this, since all the civil or foreign wars in which they have been engaged have originated in the ambition and personal views of some of the principal families, such as the Lesbeks, the Djambelats, and the Ismaels of Solyma. The scheiks of these houses, who alone possess one tenth part of the country, procured retainers by means of their money, and at last involved all the Druses in their dissensions. It must be owned, however, that possibly to this conflict between contending parties the whole nation owes the good fortune of never having been enslaved by its chief.

This chief, called *Hakem* or governor, and also *Emir* or prince, is a sort of king or general, who unites in his own person the civil and military powers. His dignity is sometimes transmitted from father to son, sometimes from one brother to another; and the succession is determined rather by force than by any certain laws. Females can in no case pretend to this inheritance. They are already excluded from succession in civil affairs, and consequently can still less expect it in political. In general the Asiatic governments are too turbulent, and their administration renders military talents too necessary, to admit of the sovereignty of women. Among the Druses, the male line of any family being extinguished, the government devolves to him who is in possession of the greatest number of suffrages and resources. But the first step used to be to obtain the approbation of the Porte, of whom he became the vassal and tributary. It even happens, that, not unfrequently, to assert its supremacy, it names the *Hakem*, contrary to the wishes of the nation, as in the case of Ismael Hasbeya, raised to that dignity by Djezzar; but this constraint lasts no longer than it is maintained by the violence which gave it birth. The office of the governor is to watch over the good order of the state, and to prevent the emirs, scheiks, and villages, from making war on each other; and in case of disobedience, he may employ force. He is also at the head of the civil power, and he names the cadis, reserving to himself the power of life and death. He collects the tribute, from which he annually pays to the pasha a stated sum. This tribute, which is called *miri*, is imposed on the mulberry trees, vineyards, cotton, and grain. All sown land pays in proportion to its extent; every foot of mulberries is taxed at three medins, or three sols nine deniers (not quite twopence). A hundred feet of vineyard pays a piastre, or forty medins; and fresh measurements are often made to preserve a just proportion. The scheiks and emirs have no exemption in this

respect; and it may truly be said that they contribute to the public stock in proportion to their fortune. The collection is made almost without expense. Each man pays his contingent at *Dair-el-kamar*, if he pleases, or to the collectors of the prince, who make a circuit round the country after the crop of silks. The surplus of this tribute is for the prince; so that it is his interest to reduce the demands of the Turks, as it would likewise be to augment the impost. But this measure requires the sanction of the scheiks, who have the privilege of opposing it. Their consent is necessary, likewise, for peace and war. In these cases, the emir must convoke general assemblies, and lay before them the state of his affairs. There every scheik, and every peasant who has any reputation for courage or understanding, is entitled to give his suffrage; so that this government may be considered as a mixture of monarchy, aristocracy, and democracy. Every thing indeed depends on circumstances. If the governor be a man of ability, he is absolute; if he be weak, he is a cipher. This proceeds from the want of fixed laws; a want common to all Asia, and the radical cause of all the disorders in the governments of the Asiatic nations.

Neither the chief nor the individual emirs maintain troops; they have only persons attached to the domestic service of their houses, and a few black slaves. When the nation makes war, every man, whether scheik or peasant, able to bear arms, is called upon to march. He takes with him a little bag of flour, a musket, some bullets, a small quantity of powder made in his village, and repairs to the rendezvous appointed by the governor. If it be a civil war, as sometimes happens, the servants, the farmers, and their friends, take up arms for their patron, or the chief of their family, and repair to his standard. In such cases, the parties irritated frequently seem on the point of proceeding to the last extremities; but they seldom have recourse to acts of violence, or attempt the death of each other. Mediators always interpose, and the quarrel is appeased the more readily, as each patron is obliged to provide his followers with provisions and ammunition.

The Druses are noted for their hospitality. Whoever presents himself at their door in the quality of a suppliant or passenger, is sure of being entertained with lodging and food in the most generous and unaffected manner. Volney often saw the lowest peasants give the last morsel of bread they had in their houses to the hungry traveller; and when it was observed to them that they wanted prudence, their answer was, "God is liberal and great, and all men are brethren." There are, therefore, no inns in their country any more than in the rest of Turkey. When they have once contracted with their guest the sacred engagement of bread and salt, no subsequent event can make them violate it. Various instances of this are related which do honour to their character. A few years ago an aga of the janissaries having been engaged in a rebellion, fled from Damascus and retired among the Druses. The pasha was informed of this, and demanded him of the emir, threatening to make war on him in case of refusal. The emir demanded him of the scheik Talhouk, who had received him; but the indignant scheik replied, "When have you known the Druses deliver up their guests? Tell the emir, that as long as Talhouk shall preserve his beard, not a hair of the head of his suppliant shall fall."

In consequence, says Volney, of their prejudices, the Druses do not choose to make alliances out of their own families. They invariably prefer their relation, though poor, to a rich stranger; and poor peasants have been known to refuse their daughters to merchants of Saide and Bairout, who possessed from twelve to fifteen thousand piastres. They

Druses.

Druses. observe also, to a certain degree, the custom of the Hebrews, which directed that a brother should espouse his brother's widow.

In short, the proper and distinctive character of the Druses is a sort of republican spirit, which gives them more energy than any other subjects of the Turkish government, and an indifference for religion, which forms a striking contrast with the zeal of the Mahomedans and Christians. In other respects, their private life, their customs and prejudices, are the same with those of other orientals. They may marry several wives, and repudiate them when they choose; but, except by the emir and a few men of eminence, that is rarely practised. The women are all veiled, so that no man knows the face of any other woman than his wife, his mother, his sister, and sisters-in-law. Every man lives in the bosom of his own family, and goes little abroad. The women, those even of the scheiks, make the bread, roast the coffee, wash the linen, cook the victuals, and perform all domestic offices. The men cultivate their lands and vineyards, and dig canals for watering them. In the evening they sometimes assemble in the court, the area, or house of the chief of the village or family. There, seated in a circle, with legs crossed, pipes in their mouths, and poniards at their belts, they discourse of their various labours, the scarcity or plenty of their harvests, peace or war, the conduct of the emir, or the amount of the taxes; they relate past transactions, discuss present interests, and form conjectures on the future. Their children, tired with play, come frequently to listen. This is the only education of those who are termed the Ignorant.

This account of the character, manners, and religious tenets of the Druses has been corroborated by modern travellers. The reverend Mr Connor, a missionary and travelling agent of the British and Foreign Bible Society, mentions that there are many sects among them; but that they are divided into two great classes, that of the Okkals or the Intelligent, who to the number of 10,000 form the sacred order; and the Djahels or Ignorant. It is stated to be extremely difficult to learn any thing satisfactory respecting the religious creed of this people. It is generally agreed that they believe in the transmigration of souls; and according to the character of the individual in his journey through life, will be the nature of the body which his soul will animate in a future state of existence. If his conduct has been fair and honourable, his soul will vivify the body of some respectable character in life. But if his conduct has been evil, his soul will enter the body of a horse, a mule, or an ass. In like manner it is believed that persons of eminent and conspicuous virtue will, as the highest recompense of their merit, pass after death into the bodies of Chinese Druses. In the schools, which are frequent among the Druses, the Okkals are generally the masters, and are paid by the pupils. They teach reading and writing, and the book generally used is the Koran. In some villages where there are Christian schools, the Druses send their children thither, where they are taught to read the Psalms of David. There are no Christians among the Druses, though the emir with his family and some of the other nobles have their children baptized, have chapels in their houses, and hear mass on Sunday, not from any rational belief in the truths of Christianity, but for the same reason that, though they dislike the Mahomedans generally, and entertain no tenet in common with their faith, yet many of them, as we learn from Buckingham, are infected with their customs, and keep the feast of Ramadan with as much rigour as the most orthodox follower of the Arabian prophet; just as the Mussulmans of India, though they despise and hate the Hindus, have nevertheless adopted many of their superstitions and ceremonies.

The Djahels or the Ignorant, who form by far the most numerous class, perform no religious rites whatever, unless when they are obliged by circumstances to assume the appearance of Mahomedans. They cherish an equal dislike to the Christians and Turks; and believe that the deity was incarnated in the person of Hakem, caliph of Egypt, and that he will shortly appear again and utterly destroy all his enemies.

The Druses are a restless and enterprising people; they are formidable in irregular war, being brave even to temerity; excellent marksmen, and noted for sudden surprises. The passion of all classes for arms is remarked by every traveller; and Buckingham mentions a keen dispute at which he was present relative to the value of different weapons, in which the sabres of Ispahan and Damascus, and the muskets and pistols of England, were unanimously preferred. They are of industrious habits, devoting their attention to the cultivation of the soil; and the same traveller, who was over all this country, on quitting a Mahomedan village and entering one inhabited by Druses, was struck with the contrast of the superior order and neatness everywhere conspicuous, as well as in the more cultivated state of the land. No great distinction of ranks is preserved among them, scheiks and peasants treating each other with the greatest familiarity. They speak pure Arabic. Soeda, which is the capital of the Eastern Druses, and the residence of their emir or prince, is about two miles westward of the summit of that range of hills which forms the eastern boundary of the plains of the Hauran.

DRUSIUS, or VANDEN DRIECHE, JOHN, a learned Protestant and eminent critic, was born at Oudenarde, in Flanders, on the 28th June 1550. Being designed for the church, he learned Greek and Latin at Ghent, and philosophy at Louvain; but his father having been outlawed for his religion, and deprived of his estate, they both retired to England, where the son became professor of oriental languages at Oxford. Upon the pacification of Ghent, however, they returned to their own country, and Drusius was appointed professor of the oriental languages at Leyden. From this place he removed to Friesland, and was admitted professor of Hebrew in the university of Franeker; an office which he discharged with great honour till his death, which happened in 1616. His works prove him to have been well skilled in Hebrew and in Jewish antiquities; and in 1600 the states-general employed him, at a salary of four hundred florins a year, to write notes on the most difficult passages in the Old Testament; but being frequently interrupted in prosecuting this undertaking, it was not published until after his death. He carried on an extensive correspondence with the learned in different countries; for, besides letters in Hebrew, Greek, and other languages, there were found amongst his papers upwards of two thousand written in Latin. He had a son, John, who died in England at the age of twenty-one, and was accounted a prodigy of learning.

Drusius, who was a man of real learning, and deserves the encomiums which Simon has bestowed on him, is also favourably mentioned by Bayle, Freher, Meursius, Foppens, Paquot, and others. Paquot states the number of the printed works and treatises of Drusius at forty-eight, and of the unprinted at upwards of twenty. Of the former more than two thirds were inserted in the collection entitled *Critici Sacri, sive Annotata doctissimorum Virorum in vetus et novum Testamentum*, Amsterdam, 1698, in 9 vols. folio, or London, 1660, in 10 vols. folio. Amongst the works of Drusius not to be found in this collection may be mentioned, 1. *Alphabetum Hebraicum vetus*, 1584, 4to; 2. *Tabulae in Grammaticam Chaldaicam ad usum Juventutis*, 1602, 8vo; 3. An edition of *Sulpitius Severus*, Franeker,

Dryades 1607, 12mo; 4. *Opuscula quæ ad Grammaticam spectant omnia*, 1609, 4to; 5. *Lacrymæ in obitum J. Scaligeri*, 1609, 4to; and 6. *Grammatica Linguae Sanctæ nova*, 1612, 4to.

DRYADES, in the heathen theology, a sort of deities or nymphs, which, the ancients thought, inhabited groves and woods. They differed from the Hamadryades, the latter being attached to some particular tree, with which they were born, and with which also they died; whereas the former were goddesses of trees and woods in general.

DRYANDER, JONAS, a Swedish naturalist of eminent talents, and a distinguished pupil of the great Linnæus, was born in 1748. His father, a clergyman near Gottenburg, died during the minority, if not the infancy, of his son; in consequence of which the care of the education of the latter devolved on a maternal uncle. This was Dr Lars Montin, a member of the Stockholm Academy, known to the world by several botanical writings, and, amongst others, by an inaugural dissertation on the genus *Splachnum*, published under the presidency of Linnæus, 28th March 1750; and reprinted in the *Amœnitates Academicæ*, vol. ii. 263. The early education of young Dryander, as far as we can learn, was chiefly in the University of Gottenburg; but he afterwards removed to Lund, where he took his degree of master of arts, or doctor in philosophy, under the presidency of Lidbeck, in 1776; on which occasion he published a dissertation, *fungos regno vegetabili vindicans*. He combated the ideas of certain philosophers, who, led by analogy rather than observation and judgment, were disposed to believe that *fungi* might, like corals and corallines, be the production of animals. But though Mr Dryander thus asserted the vegetable nature of these bodies, he subsequently imbibed, from his friend and preceptor Linnæus, an insuperable dislike to their use as food; nor could the most delicate mushrooms of the most luxurious table ever tempt him to overcome this prejudice. We know not at what period he went to study at Upsal, nor how long he remained there. He became for some time domestic tutor to a young Swedish nobleman, after which he visited England, under the patronage of his countryman the well-known Dr Solander, who introduced him to the acquaintance of Sir Joseph Banks; and on the sudden death of Solander in 1782, he succeeded to the place of that eminent man, in the confidence and friendship of his distinguished patron. He was, in like manner, domesticated under the roof of Sir Joseph as his librarian, and continued in that situation as long as he lived. Mr Dryander also held the offices of librarian to the Royal and the Linnæan Societies. He was one of the first founders of the latter in 1788; and took a principal interest in all its concerns, especially in drawing up its laws and regulations, when this society was incorporated by royal charter in 1802. He, moreover, fulfilled the duties of a very active vice-president, till the time of his decease, which happened towards the end of October 1810, in the sixty-third year of his age. His remains were deposited in the vault of St Ann's Church, Soho, the funeral being attended by a number of his friends, principally members of the Linnæan Society.

The acknowledged publications of Mr Dryander on the subject of botany consist of the following dissertations: 1. *An Account of the Genus Albuca*, in the *Stockholm Transactions* for 1784, in Swedish; 2. *Observations on the Genus Begonia*, in the *Transactions of the Linnæan Society*, vol. i. In this essay twenty-one species are determined, with an indication of nine doubtful ones, though the genus was previously supposed to consist of a solitary species only. 3. *On Genera and Species of Plants which occur twice or three times in Professor Gmelin's edition of Linnæus's Systema Naturæ*; *Trans. of Linn. Soc.* vol. ii.

These corrections unfortunately extend no farther than the class *Octandria*. Their author intended to have completed them, but other occupations intervened; and the book which was the object of his correction soon fell into absolute neglect, as far as regards botany; insomuch that its errors, however great and numerous, became harmless. 4. *Lindsea, a new Genus of Ferns*; *Trans. of Linn. Soc.* vol. iii. This genus is distinguished from *Pteris*, by the *involucrum* opening outward. 5. *Botanical Description of the Benjamin Tree of Sumatra*, in the *Phil. Trans.* vol. lxxvii. The tree in question, about which great mistakes had arisen, is here shown to be a species of *Styrax*. This paper has been republished and translated.

The principal works published under the superintendence and correction of the subject of this memoir, were, the *Hortus Kewensis* of Mr Aiton, printed in 1789, and about half the second edition of the same work, interrupted by his death; as well as Dr Roxburgh's *Plants of the Coast of Coromandel*, a splendid and highly valuable publication, for which the world is indebted to the munificence of the East India Company. To both these the critical learning and accuracy of Mr Dryander were most usefully applied, especially in the typographical department. It would be vain to seek for an error in the printing of any thing which had passed through his hands. We have only to regret that the same critical correctness was not extended as a principle to every other department of the works in which he took a part. Had this been the case, the erroneous essential character of *Oldenlandia*, copied in *Hortus Kewensis* from Linnæus and Willdenow, would not have been allowed to contradict the plate and description of Roxburgh, cited underneath. But, above all, various inaccuracies and faults in nomenclature are propagated and confirmed by an authority which Mr Dryander himself never intended to give. He has often assured the writer of this notice, that, had he published in his own name, he would not have adopted such inaccuracies; which is mentioned here to prevent the errors of others being laid to his charge. The popular *Species Plantarum* of Willdenow being the avowed guide, the author of that work must be responsible for matters which it did not come within the scope of the author or editor of the *Hortus Kewensis* to correct. Many subjects, however, are most skilfully elucidated in this publication, as well as in the sequel of its second edition by Mr Brown, and these cannot escape the discrimination of an intelligent reader. Practical botany was but a secondary or occasional pursuit of Mr Dryander, and he had a diffidence of his powers, and a consequent distaste for the technical and descriptive parts of the science. The descriptions he had prepared for Mr Bauer's splendid figures of *Ericæ*, published by Mr Aiton, were readily and even gladly thrown into the fire, on occasion of a difference of opinion respecting the intended title of the work.

The study in which this most acute and correct man found ample scope for the exercise of his talents was bibliography. His *Catalogus Bibliothecæ Historico-Naturalis Josephi Banks*, is a model for all future writers in this line; but a model rather calculated to check than to excite imitation. A work so ingenious in design, and so perfect in execution, can scarcely be produced in any science; so faultless a specimen of typography we have never elsewhere seen. The frank and unvarnished sincerity of Mr Dryander's character was secondary only to his universal and fastidious exactness upon every subject that came under his notice. He could not be a silent witness of the slightest injustice, misrepresentation, or misconception. His impatience of contradiction arose more from the quickness of his penetration into the confusion and inaccuracy of ordinary intellects and charac-

Dryden. ters, than from any natural severity. All clearness, honesty, and precision himself, he had little indulgence for those who fell short of his standard, and these were the greater part of mankind. On being asked what share Dr Smith had in the composition of the *Flora Græca*, he replied, with a vehemence which startled the inquirer, "Every word!" When teased, as was too often his lot, by the questions of the heedless and superficial, he never neglected the duties of the office he had undertaken, if he could not always conceal his impatience under their performance. But when the humblest cultivator of real science applied for his assistance, all his stores were laid open; the most condescending liberality graced his conversation; and he was careful that what he communicated should not only be heard but understood. The versatility of his genius and conversation was no less admirable than their exactness. Whether the subject were a question in science, or a point of history; the politics of Europe, or the tittle-tattle of an obscure German court; the literary talents and performances of any distinguished man, or his private transactions; the intrigues for a place at court, a professorship, or a domestic establishment; he was sure to throw some light upon it. Few men are more missed in the circle in which he moved, nor can his place in general society be readily supplied. (x. x.)

DRYDEN, JOHN, an illustrious English poet, descended of a respectable family in Huntingdonshire, was born at Aldwinckle, in that county, on the 9th August 1631. He was educated under Dr Bushby at Westminster school, whence he removed to Cambridge in 1650, having been elected scholar of Trinity College, of which he appears to have been afterwards a fellow. In his earlier days he gave no extraordinary indications of genius; for even the year before he quitted the university, he wrote a poem on the death of Lord Hastings, which by no means exhibits a presage of that perfection in poetical composition which he was afterwards destined to attain.

On the death of Oliver Cromwell he wrote some "heroic stanzas" to the memory of the Lord Protector; but after the Restoration, being desirous of ingratiating himself with the new monarch, he wrote, first, a poem entitled *Astræa Redux*, and afterwards a panegyric on the king upon the occasion of his coronation. In 1662, he addressed a poem to the lord chancellor Hyde, presented on new year's day; and in the same year he published a satire on the Dutch. In 1668 appeared his *Annus Mirabilis*, or the Year of Wonders, an historical poem, intended to celebrate the Duke of York's victory over the Dutch. These pieces at length obtained him the favour of the crown; and Sir William Davenant having died the same year, 1668, Mr Dryden was appointed to succeed him as poet-laureat and historiographer to Charles II.; and accordingly he entered upon the office, though his patent was not signed until the year 1670. The pension of the two offices was L.200 a year. About this time also his inclination to write for the stage seems first to have evinced itself. For besides his concern

with Sir William Davenant in the alteration of Shakspeare's *Tempest*, he in 1669 produced his *Wild Gallants*, a comedy, which met with very indifferent success. Yet the author, not discouraged by its failure, soon published his *Indian Emperor*, which having experienced a more favourable reception, encouraged him to proceed. He did so, and that with so great rapidity, that in the key to the Duke of Buckingham's *Rehearsal* he is recorded to have engaged himself by contract to write four plays in the year; and, indeed, in the years 1679 and 1680 he appears to have fulfilled this obligation. To this unhappy necessity which he lay under are to be attributed all those irregular and bombastic flights, and sometimes even puerile exuberances, for which he has been so severely criticised, and which, in the unavoidable hurry he usually wrote in, it was impossible for him to find time either to lop off or to correct.

In 1675, the Earl of Rochester, whose envious disposition did not allow him patiently to see growing merit meet with its due reward, and who therefore felt chagrined at the just applause with which Dryden's dramatic pieces had been received, was determined if possible to shake his interest at court; and he succeeded so far as to recommend one Crowne, an obscure author, to write a mask for the court, a service which of course belonged to Mr Dryden as poet-laureat. Nor was this the only attack, or indeed the most formidable one, which Dryden's fame drew upon him; for, some years before this, the Duke of Buckingham, a man of licentious character, but of great wit, had severely ridiculed several of our author's plays in his piece called the *Rehearsal*. But though the intrinsic wit which runs through this performance cannot, even at the present day, fail to excite our laughter, yet, as ridicule is not always the test of truth, it ought not to form the standard by which to fix Dryden's poetical reputation, more especially when we consider that the pieces therein ridiculed are not the masterpieces of Dryden; that the very passages burlesqued are frequently, in their original places, much less ridiculous than when thus detached, like a rotten limb, from the body of the work, exposed to view with additional distortions, and divested of that connection with the other parts which gave it not only symmetry, but beauty; and, lastly, that the beauties, which the critic has kept in the back-ground, are infinitely more numerous than the deformities which he has thus industriously brought forth into immediate view.¹

Dryden, however, did not suffer these attacks to pass with impunity; for in 1679 there appeared an *Essay on Satire*, said to have been written jointly by himself and the Earl of Mulgrave, containing some very severe reflections on the Earl of Rochester and the Duchess of Portsmouth, who, it is not improbable, might have been instrumental in the affront shown to Dryden; and in 1681 he published his *Absalom and Achitophel*, in which the well-known character of Zimri, drawn for the Duke of Buckingham, is certainly severe enough to repay all the ridicule thrown on him by that nobleman in the character of Bayes.² The

¹ Dryden affected to despise the satire of the *Rehearsal*, which, however, he must have felt acutely. In the dedication prefixed to his translation of Juvenal and Persius, he observes, speaking of the many lampoons and libels which had been written against him, "I answered not the *Rehearsal*, because I knew the author sat to himself when he drew the picture, and was the very Bayes of his own farce; because also I knew, that my betters were more concerned than I was in that satire; and, lastly, because Mr Smith and Mr Johnson, the main pillars of it, were two such languishing gentlemen in their conversation, that I could liken them to nothing but their own relations, those noble characters of men of wit and pleasure about town." But notwithstanding this affected insensibility, Dryden did not fail to take his revenge, as will be seen in the succeeding paragraph of the text.

² Dryden left the story unfinished; and the reason he assigns for doing so is, because he could not prevail upon himself to exhibit Absalom as unfortunate. "Were I the inventor," says he, "who am only the historian, I should certainly conclude the piece with the reconciliation of Absalom to David. And who knows but this may come to pass? Things were not brought to extremity where I left the story; there seems to be yet room left for a composure: hereafter there may be only for pity. I have not so much as an uncharitable wish against Achitophel; but am content to be accused of good-natured error, and to hope, with Origen, that the devil himself may at last be saved. For which reason, in this poem, he is neither brought to set his house in order, nor to dispose of his person afterwards." Nevertheless, a second part of *Absalom and Achitophel* was undertaken and written by Tate, at the request and under the direction of Dryden, who wrote nearly two hundred lines of it himself.

Dryden. resentment shown by these peers was, however, different and characteristic. Lord Rochester, who was a coward as well as a man of the most depraved morals, basely hired three ruffians to cudgel Dryden in a coffeehouse; whilst the Duke of Buckingham, in a more open manner, took the task upon himself, and at the same time presented the poet with a purse containing no very trifling sum of money; telling him that he inflicted the beating as a punishment for his impudence, but bestowed the gold as a reward for his wit.

In 1680 was published a translation of Ovid's *Epistles* in English verse by several hands, two of which, together with the preface, were by Mr Dryden; and in 1682 appeared his *Religio Laici*, designed as a defence of revealed religion, against deists, infidels, *et hoc genus omne*. Soon after the accession of King James II. our author changed his religion for that of the church of Rome, and wrote two pieces in vindication of the Catholic tenets; namely, *A Defence of the Papers written by the late King*, found in his strong box; and the celebrated poem, afterwards answered by Lord Halifax, entitled *The Hind and the Panther*. By this extraordinary step he not only engaged himself in controversy, and incurred much censure and ridicule from the contemporary wits, but on the accomplishment of the revolution, being, by reason of his new religion, disqualified from bearing any office under the government, he was stripped of the laurel, which, to his still greater mortification, was bestowed on Richard Flecknoe, a man for whom he had a most settled aversion. This circumstance occasioned his writing the severely satirical poem called *MacFlecknoe*.

Dryden's circumstances had never been affluent; but being now deprived of this little support, he found himself reduced to the necessity of writing for bread. We consequently find him from this period engaged in tasks of labour as well as genius, namely, in translating the works of others; and to this necessity perhaps our nation stands indebted for some of the best translations extant. In the year when he lost the laurel, he published the life of St Francis Xavier from the French. In 1693 appeared a translation of Juvenal and Persius; in the first of which he had a considerable hand, and of the latter the entire execution. In 1695 was published his prose version of Fresnoy's *Art of Painting*; and in the year 1697 he gave to the world that translation of Virgil's works which still does, and perhaps ever will, hold the first place amongst all attempts of the kind. The smaller pieces of this eminent writer, such as prologues, epilogues, epitaphs, elegies, songs, and the like, are too numerous to be specified here, though now all happily collected in Sir Walter Scott's edition of his works. His last work is what is called his *Fables*, consisting of many of the most interesting stories in Homer, Ovid, Boccaccio, and Chaucer, translated or modernized in the most elegant and poetical manner; together with some original pieces, among which is the Ode to St Cecilia's Day. This last composition, though written in the very decline of the author's life, and at a period when old age and distress had conspired to damp his poetic ardour, and enfeeble the wings of fancy, possesses nevertheless as much of both as would have been sufficient to render him immortal had he never written a single line besides.

Dryden married Lady Elizabeth Howard, the daughter of the Earl of Berkshire, who survived him about eight years, though for the last four of them she was a lunatic, having been deprived of her senses by a nervous fever. By this lady he had three sons; Charles, John, and Henry. After a long life, harassed with the most laborious of all fatigues, that of the mind, and continually rendered anxious by distress and difficulty, he expired on the

1st of May 1701. Dryden had no monument erected to him for several years; a circumstance to which Mr Pope alludes in his epitaph intended for Mr Rowe. Upon this hint Sheffield duke of Buckingham erected a tomb, for which the following epitaph was originally intended:

This Sheffield rais'd—the sacred dust below
Was Dryden once; the rest, who does not know?

But this was afterwards changed into the plain inscription still to be seen on the monument, containing merely the dates of the poet's birth and death, together with the fact of the tomb having been erected by John Sheffield, duke of Buckingham.

Mr Dryden's character has been variously estimated by different writers, some of whom have exalted it by the highest commendation, and others debased it by the severest censure. The latter, however, we must charge to that strong spirit of party which prevailed during the greater part of Dryden's lifetime, and which ought therefore to be taken with great allowances. From some parts of his history, however, he appears to have been unsteady, and to have too readily temporized with the several revolutions in church and state. But this might in some measure have been owing to that natural timidity and diffidence of disposition, which almost all writers seem agreed that he possessed. Congreve, whose authority cannot be suspected, has given us such an account of him as must make him appear no less amiable in his private character as a man, than he was illustrious in his public capacity as a poet. In the former capacity, according to Congreve, he was humane, compassionate, forgiving, and sincerely friendly; of extensive reading, tenacious memory, and ready communication; gentle in the correction of the writings of others, and patient under the reprehension of his own deficiencies; easy of access himself, but slow and diffident in his advances to others; and of all men the most modest and the most easy to be discountenanced in his approaches either to his superiors or to his equals. In the latter the highest testimonies have been borne to his merits by some of the greatest men.

Pope had a very high opinion of Dryden. In a letter to Wycherly he says, "It was certainly a great satisfaction to me to see and converse with a man whom in his writings I had so long known with pleasure; but it was a very high addition to it, to hear you at our very first meeting doing justice to your dead friend Mr Dryden. I was not so happy as to know him; *Virgilium tantum vidi*. Had I been born early enough, I must have known and loved him; for I have been assured, not only by yourself, but by Mr Congreve and Sir William Trumball, that his personal qualities were as amiable as his poetical, notwithstanding the many libellous misrepresentations of them; against which the former of these gentlemen has told me he will one day vindicate him." But what Congreve and Pope have said of Dryden is rather in the way of panegyric than as an exact and impartial character. Other writers, however, have spoken of him with greater moderation, yet probably without doing him any injustice. Thus, according to Felton, "he at once gave the best rules, and broke them, in spite of his own knowledge, and the *Rehearsal*. His prefaces are many of them admirable upon dramatic writings: he had some peculiar notions, which he maintains with great address; but his judgment in disputed points is of less weight and value, because the inconstancy of his temper did run into his thoughts, and mixed with the conduct of his writings, as well as his life." Voltaire describes him as "a writer whose genius was too exuberant, and not accompanied with judgment enough;" and he adds, that "if he, Dryden, had written only a tenth part of the works he left behind him, his character would

Dryden. have been conspicuous in every part. But," says the philosopher of Ferney, "his great fault is his having endeavoured to be universal." "Perhaps no nation," says Dr Johnson, "ever produced a writer that enriched his language with such a variety of models. To him we owe the improvement, perhaps the completion, of our metre, the refinement of our language, and much of the correctness of our sentiments. By him we were taught 'sapere et fari,' to think naturally and express forcibly. Though Davies has reasoned in rhyme before him, it may be perhaps maintained that he was the first who joined argument with poetry. He showed us the true bounds of a translator's liberty. What was said of Rome adorned by Augustus, may be applied by an easy metaphor to English poetry embellished by Dryden, 'lateritiam invenit, marmoream reliquit'; he found it brick, and he left it marble." The public voice, indeed, has assigned to Dryden the first place in the second rank of our poets; no mean station in a table of intellectual precedence so rich in illustrious names: and it is allowed that, even of the few who were his superiors in genius, none has exercised a more extensive or permanent influence on the national habits of thought and expression. In the following noble passage from an article in the *Edinburgh Review* (vol. xivii. p. 29), the great attributes of Dryden's character and genius are unfolded with striking vigour of diction and splendour of illustration.

"If Dryden had died before the expiration of the first of the periods into which we have divided his literary life, he would have left a reputation, at best, little higher than that of Lee or Davenant. He would have been known only to men of letters; and by them he would have been mentioned as a writer who threw away, on subjects which he was incompetent to treat, powers which, judiciously employed, might have raised him to eminence, whose diction and whose numbers had sometimes very high merit, but all whose works were blemished by a false taste, and by errors of gross negligence. A few of his prologues and epilogues might perhaps still have been remembered and quoted. In these little pieces, he early showed all the powers which afterwards rendered him the greatest of modern satirists. But during the latter part of his life he gradually abandoned the drama. His plays appeared at longer intervals. He renounced rhyme in tragedy. His language became less turgid, his characters less exaggerated. He did not indeed produce correct representations of human nature; but he ceased to daub such monstrous chimeras as those which abound in his earlier pieces. Here and there passages occur worthy of the best ages of the British stage. The style which the drama requires changes with every change of character and situation. He who can vary his manner to suit the variation, is the great dramatist; but he who excels in one manner only, will, when that manner happens to be appropriate, appear to be a great dramatist; as the hands of a watch which does not go point right once in the twelve hours. Sometimes there is a scene of solemn debate. This a mere rhetorician may write as well as the greatest tragedian that ever lived. We confess that to us the speech of Sempronius in Cato seems very nearly as good as Shakspeare could have made it. But when the senate breaks up, and we find that the lovers and their mistresses, the hero, the villain, and the deputy-villain, all continue to harangue in the same style, we perceive the difference between a man who can write a play and a man who can write a speech. In the same manner, wit, a talent for description, or a talent for narration, may, for a time, pass for dramatic genius. Dryden was an incomparable reasoner in verse. He was conscious of his power; he was proud of it; and the authors of the *Rehearsal* justly

charged him with abusing it. His warriors and princesses are fond of discussing points of amorous casuistry, such as would have delighted a parliament of love. They frequently go still deeper, and speculate on philosophical necessity and the origin of evil.

"There were, however, some occasions which absolutely required this peculiar talent. Then Dryden was indeed at home. All his best scenes are of this description. They are all between men; for the heroes of Dryden, like many other gentlemen, can never talk sense when ladies are in company. They are all intended to exhibit the empire of reason over violent passion. We have two interlocutors, the one eager and impassioned, the other high, cool, and judicious. The composed and rational character gradually acquires the ascendancy. His fierce companion is first inflamed to rage by his reproaches, then overawed by his equanimity, convinced by his arguments, and soothed by his persuasions. This is the case in the scene between Hector and Troilus, in that between Antony and Ventidius, and in that between Sebastian and Dorax. Nothing of the same kind in Shakspeare is equal to them, except the quarrel between Brutus and Cassius, which is worth them all three.

"Some years before his death, Dryden altogether ceased to write for the stage. He had turned his powers in a new direction, with success the most splendid and decisive. His taste had gradually awakened his creative faculties. The first rank in poetry was beyond his reach, but he challenged and secured the most honourable place in the second. His imagination resembled the wings of an ostrich. It enabled him to run, though not to soar. When he attempted the highest flights, he became ridiculous; but while he remained in a lower region, he outstripped all competitors.

"All his natural, and all his acquired powers, fitted him to found a good critical school of poetry. Indeed he carried his reforms too far for his age. After his death our literature retrograded; and a century was necessary to bring it back to the point at which he left it. The general soundness and healthfulness of his mental constitution, his information, of vast superficies though of small volume, his wit scarcely inferior to that of the most distinguished followers of Donne, his eloquence, grave, deliberate, and commanding, could not save him from disgraceful failure as a rival of Shakspeare, but raised him far above the level of Boileau. His command of language was immense. With him died the secret of the old poetical diction of England, the art of producing rich effects by familiar words. In the following century, it was as completely lost as the Gothic method of painting glass, and was but poorly supplied by the laborious and tesselated imitations of Mason and Gray. On the other hand, he was the first writer under whose skilful management the scientific vocabulary fell into natural and pleasing verse. In this department he succeeded as completely as his contemporary Gibbons succeeded in the similar enterprise of carving the most delicate flowers from heart of oak. The toughest and most knotty parts of language became ductile at his touch. His versification, in the same manner, while it gave the first model of that neatness and precision which the following generation esteemed so highly, exhibited, at the same time, the last examples of nobleness, freedom, variety of pause and cadence. His tragedies in rhyme, however worthless in themselves, had at least served the purpose of nonsense-verses: they had taught him all the arts of melody which the heroic couplet admits. For bombast, his prevailing vice, his new subjects gave little opportunity; his better taste gradually discarded it.

"He possessed, as we have said, in a pre-eminent de-

Dryden. gree, the power of reasoning in verse; and this power was now peculiarly useful to him. His logic is by no means uniformly sound. On points of criticism he always reasons ingeniously, and, when he is disposed to be honest, correctly; but the theological and political questions which he undertook to treat in verse were precisely those which he understood least. His arguments, therefore, are often worthless; but the manner in which they are stated is beyond all praise. The style is transparent. The topics follow each other in the happiest order. The objections are drawn up in such a manner that the whole fire of the reply may be brought to bear on them. The circumlocutions which are substituted for technical phrases are clear, neat, and exact. The illustrations at once adorn and elucidate the reasoning. The sparkling epigrams of Cowley, and the simple garrulity of the burlesque poets of Italy, are alternately employed in the happiest manner, to give effect to what is obvious, or clearness to what is obscure.

"His literary creed was catholic, even to latitudinarianism, not from any want of acuteness, but from a disposition to be easily satisfied. He was quick to discern the smallest glimpse of merit; he was indulgent even to gross improprieties when accompanied by any redeeming talent. When he said a severe thing, it was to serve a temporary purpose, to support an argument or to tease a rival. Never was so able a critic so free from fastidiousness. He loved the old poets, especially Shakspeare. He admired the ingenuity which Donne and Cowley had so wildly abused. He did justice, amidst the general silence, to the memory of Milton. He praised to the skies the school-boy lines of Addison. Always looking on the fair side of every object, he admired extravagance, on account of the invention which he supposed it to indicate; he excused affectation in favour of wit; he tolerated even tameness for the sake of the correctness which was its concomitant.

"It was probably to this turn of mind, rather than to the more disgraceful causes which Johnson has assigned, that we are to attribute the exaggeration which disfigures the panegyrics of Dryden. No writer, it must be owned, has carried the flattery of dedication to a greater length; but this was not, we suspect, merely interested servility: it was the overflowing of a mind singularly disposed to admiration, of a mind which diminished vices, and magnified virtues and obligations. The most adulatory of his addresses is that in which he dedicates the State of Innocence to Mary of Modena. Johnson thinks it strange that any man should use such language without self-detestation; but he has not remarked, that to the very same work is prefixed an eulogium on Milton, which certainly could not have been acceptable to the court of Charles II. Many years later, when Whig principles were in a great measure triumphant, Sprat refused to admit a monument of John Philips into Westminster Abbey, because, in the epitaph, the name of Milton incidentally occurred. The walls of his church, he declared, should not be polluted by the name of a republican. Dryden was attached both by principle and interest to the court; but nothing could deaden his sensibility to excellence. We are unwilling to accuse him severely, because the same disposition which prompted him to pay so generous a tribute to the memory of a poet whom his patrons detested, hurried him into extravagance when he described a princess distinguished by the splendour of her beauty and the graciousness of her manners.

"This is an amiable temper, but it is not the temper of great men. Where there is elevation of character there will be fastidiousness. It is only in novels and on tombstones that we meet with people who are indulgent to the

faults of others and unmerciful to their own, and Dryden at all events was not one of these paragons. His charity was extended most liberally to others, but it certainly began at home. In taste he was by no means deficient. His critical works are beyond all comparison superior to any which had till then appeared in England. They were generally intended as apologies for his own poems, rather than as expositions of general principles; he, therefore, often attempts to deceive the reader by sophistry, which could scarcely have deceived himself. His dicta are the dicta, not of a judge, but of an advocate, and often of an advocate in an unsound cause; yet in the very act of misrepresenting the laws of composition he shows how well he understands them; but he was perpetually acting against his better knowledge. His sins were sins against light: he trusted that what was bad would be pardoned for the sake of what was good; what was good he took no pains to make better. He was not, like most persons who rise to eminence, dissatisfied even with his worst productions. He had set up no unattainable standard of perfection, the contemplation of which might at once improve and mortify him. His path was not attended by an unapproachable mirage of excellence, for ever receding and for ever pursued. He was not disgusted by the negligence of others, and he extended the same toleration to himself. His mind was of a slovenly character; fond of splendour, but indifferent to neatness. Hence most of his writings exhibit the sluttish magnificence of a Russian noble, all vermin and diamonds, dirty linen and inestimable sables. Those faults which spring from affectation, time and thought in a great measure removed from his poems; but his carelessness he retained to the last. If towards the close of his life he less frequently went wrong from negligence, it was only because long habits of composition rendered it more easy to go right. In his best pieces we find false rhymes, triplets in which the third line appears to be a mere intruder, and while it breaks the music, adds nothing to the meaning; gigantic Alexandrines of fourteen and sixteen syllables, and truncated verses for which he never troubled himself to find a termination or a partner.

"Such are the beauties and the faults which may be found in profusion throughout the later works of Dryden. A more just and complete estimate of his natural and acquired powers, of the merits of his style and of its blemishes, may be formed from the *Hind and Panther*, than from any of his other writings. As a didactic poem, it is far superior to the *Religio Laici*. The satirical parts, particularly the character of Burnet, are scarcely inferior to the best passages in *Absalom and Achitophel*. There are, moreover, occasional touches of a tenderness, which affects us more, because it is decent, rational, and manly, and reminds us of the best scenes in his tragedies. His versification sinks and swells in happy unison with the subject, and his wealth of language seems to be unlimited. Yet the carelessness with which he has constructed his plot, and the innumerable inconsistencies into which he is every moment falling, detract much from the pleasure which such various excellence affords.

"In *Absalom and Achitophel* he hit upon a new and rich vein, which he worked with signal success. The ancient satirists were the subjects of a despotic government. They were compelled to abstain from political topics, and to confine their attention to the frailties of private life. They might, indeed, sometimes venture to take liberties with public men,

Quorum Flaminia tegitur cinis atque Latina.

Thus Juvenal immortalized the obsequious senators who met to decide the fate of the memorable turbot. His fourth satire frequently reminds us of the great political

Dryden
||
Dry Rot.

poem of Dryden; but it was not written till Domitian had fallen, and it wants something of the peculiar flavour which belongs to contemporary invective alone. His anger has stood so long, that though the body is not impaired, the effervescence, the first cream, is gone. Boileau lay under similar restraints, and, if he had been free from all restraint, would have been no match for our countryman.

"The advantages which Dryden derived from the nature of his subject he improved to the very utmost. His manner is almost perfect. The style of Horace and Boileau is fit only for light subjects. The Frenchman did indeed attempt to turn the theological reasonings of the Provincial Letter into verse, but with very indifferent success. The glitter of Pope is cold: the ardour of Persius is without brilliancy. Magnificent versification and ingenious combinations rarely harmonize with the expression of deep feeling. In Juvenal and Dryden alone we have the sparkle and the heat together. Those great satirists succeeded in communicating the fervour of their feelings to materials the most incombustible, and kindled the whole mass into a blaze at once dazzling and destructive. We cannot indeed think, without regret, of the part which so eminent a writer as Dryden took in the disputes of that period. There was, no doubt, madness and wickedness on both sides; but there was liberty on the one and despotism on the other. On this point, however, we will not dwell. At Talavera the English and French troops for a moment suspended their conflict to drink of a stream which flowed between them. The shells were passed across from enemy to enemy without apprehension or molestation. We, in the same manner, would rather assist our political adversaries to drink with us of that fountain of intellectual pleasure which should be the common refreshment of both parties, than disturb and pollute it with the havoc of unseasonable hostilities.

"*MacFlecknoe* is inferior to *Absalom* and *Achitophel* only in the subject: in the execution it is even superior. But the greatest work of Dryden was the last, the Ode on St Cecilia's Day. It is the masterpiece of the second class of poetry, and ranks but just below the great models of the first. It reminds us of the Pegasus of Achilles—

ὄς, καὶ θυγὴς ἰὼν, ἔπει' ἵπποις ἀλαλάτοις.

By comparing it with the impotent ravings of the heroic tragedies, we may measure the progress which the mind of Dryden had made. He had learned to avoid a too audacious competition with higher natures, to keep at a distance from the verge of bombast or nonsense, to venture on no expression which did not convey a distinct idea to his own mind. There is none of that 'darkness visible' of style which he had formerly affected, and in which the greatest poets only can succeed. Every thing is definite, significant, and picturesque. His early writings resemble the gigantic works of those Chinese gardeners who attempt to rival nature herself, to form cataracts of

terrific height and sound, to raise precipitous ridges of mountains, and to imitate in artificial plantations the vastness and the gloom of some primeval forest. This manner he abandoned; nor did he ever adopt the Dutch taste which Pope affected, the trim parterres and the rectangular walks. He rather resembled our Kents and Browns, who, imitating the great features of landscape without emulating them, consulting the genius of the place, assisting nature, and carefully disguising their art, produced, not a Chamouni or a Niagara, but a Stowe or a Hagley.

"We are, on the whole, inclined to regret that Dryden did not accomplish his purpose of writing an epic poem. It certainly would not have been a work of the highest rank. It would not have rivalled the *Iliad*, the *Odyssey*, or the *Paradise Lost*; but it would have been superior to the productions of Apollonius, Lucan, or Statius, and not inferior to the *Jerusalem Delivered*. It would probably have been a vigorous narrative, animated with something of the spirit of the old romances, enriched with much splendid description, and interspersed with fine declamations and disquisitions. The danger of Dryden would have been from aiming too high; from dwelling too much, for example, on his kingdoms of angels, and attempting a competition with that great writer, who in his own time had so incomparably succeeded in representing to us the sights and sounds of another world. To Milton, and to Milton alone, belonged the secrets of the great deep, the beach of sulphur, the ocean of fire, the palaces of the fallen dominations glimmering through the everlasting shade, the silent wilderness of verdure and fragrance where armed angels kept watch over the sleep of the first lovers, the portico of diamond, the sea of jasper, the sapphire pavement empurpled with celestial roses, and the infinite ranks of the cherubim, blazing with adamant and gold. The council, the tournament, the procession, the crowded cathedral, the camp, the guard-room, the chase, were the proper scenes for Dryden.

"But we have not space to pass in review all the works which Dryden wrote. We, therefore, will not speculate longer on those which he might possibly have written. He may, on the whole, be pronounced to have been a man possessed of splendid talents, which he often abused, and of a sound judgment, the admonitions of which he often neglected; a man who succeeded only in an inferior department of his art, but who, in that department, succeeded pre-eminently; and who, with a more independent spirit, a more anxious desire of excellence, and more respect for himself, would, in his own walk, have attained to absolute perfection."

Among the recent editions of Dryden's works may be mentioned, the *Prose Works*, by Malone, 1800, in 4 vols.; the *Poetical Works*, with notes by Warton, and edited by Todd, 1812, in 4 vols. 8vo; and the whole of his Works, with a Life by the late Sir Walter Scott, Edinburgh, 1808, in 18 vols. 8vo.

DRY ROT,

A MOST destructive, and apparently infectious disease in timber, which, by decomposing the fibres, deprives it of all strength, and in no great length of time reduces it to a mass of dry dust; a circumstance from which it seems to have derived its name, which, perhaps, would better be expressed by that of *sap rot*.

Though this disease must from its nature have been co-existent with timber-trees, it would not seem to have excited much attention, and perhaps was not known, certainly not by its present name, beyond the middle of the

last century; at some period, we rather think, of Sir John Pringle's presidency of the Royal Society of London. But for a long time after this little notice appears to have been taken of it; its ravages being, in all probability, inconsiderable, in comparison with what they have been of late years. Even now, the disease is in fact chiefly confined to modern built houses and modern built ships, and more particularly to the ships of his majesty's navy. The proximate cause of it has, therefore, rightly enough, as it would seem, been ascribed to the unseasonable state of

Dryden
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Dry Rot.

Dry Rot. the timber, when placed in certain situations, and under particular circumstances. It could not fail, in the course of the late long protracted war, to become a matter of general observation, that a more rapid decay than usual had become almost universal throughout the fleet, and especially amongst the newest and most recently repaired ships. Many anxious inquiries were instituted, and experiments made, with the view of ascertaining the real cause of a decay, the further prevention of which was so highly important to the national welfare and security. The alarm was greatly increased when, in 1810, the Queen Charlotte, a first-rate ship of war, shortly afterwards launched at Deptford, was discovered, after a close examination, to have all her upper works infected with the *dry rot*; or, in other words, the ends of most of the beams, carlings, and ledges, the joinings of the planks, &c. were observed to be covered with a mouldy, fibrous, and reticulated crust, and the parts of the timber so covered to be perfectly rotten. All the newspapers and journals of the day were filled with this alarming fact, and in consequence thereof a multitude of *dry rot* doctors proffered their assistance; one having a nostrum for eradicating the disease where it had made its appearance, and another for preventing its further approach. Some of these specifics were expensive and inconvenient, many of them impracticable of application, and most of them futile and objectionable in one way or another. These doctors, in fact, like the physicians for the human body when the seat of the disease is unknown, were labouring altogether in the dark, having no other guide to direct them than their own whims and fancies, each being ignorant of the effect of the respective experiments which they wished to try on this diseased machine.

Alarming progress of. Since the period in question a number of treatises have been written on the subject, for the prevention and cure of the dry rot in ships and houses; some wild and visionary enough, and others exhibiting the proofs of plain practical good sense, deduced from long observation, or the result of judicious experiment. Of the latter description may safely be mentioned *A Treatise on the Dry Rot in Timber*, written in 1815 by the late Mr Thomas Wade, who died previous to its publication, and whilst employed in making experiments in the dock-yards; and also another *On the Prevention of Timber from Premature Decay*, by Mr Chapman, 1817. *A Treatise on the Dry Rot*, by Mr Bowden of the Navy Office, is in many respects deserving of notice, in as far as the facts and his observations on the management of timber are carried; but he unluckily sets out with a fanciful theory, which, however, is not his own, concerning the generation of *fungi*, and their connection with the dry rot, to which, like most theorists, he endeavours to make all his facts subservient. In Mr M'William's *Essay on the Origin and Operation of the Dry Rot*, published in 1818, we find stuffed into a large quarto almost every theory and every fact gathered from preceding writers, from Aristotle down to Mr Ralph Dodd, civil engineer, who has also published his *Practical Observations on the Dry Rot in Timber*; which work appears to be little more than an advertisement of *A Dry Rot Preventive*, a nostrum which, it would seem, is too valuable to be disclosed, without calling in the doctor that he may get his fee. We have also in print the opinions and the specifics of Mr Gregory, Mr Ogg, and many others of minor note, all of whom profess to explain the cause, to secure the prevention, and to effect the cure of the *dry rot*.

Process of the common rot. These authors are at variance amongst themselves, whether the *common rot* in timber, and the *dry rot*, be not one and the same disease. A little reflection, however, will, we conceive, lead us to consider them as essentially dif-

Dry Rot. ferent, both in the symptoms, the progress, and the causes, though the *effect* of destroying the fibre of the wood is pretty nearly the same. If a post of wood, for instance, be driven into the ground, seasoned or unseasoned, it will speedily begin to decay just at the surface of the ground, or, as it were, between the earth and the air; if driven into the earth through water, as in a pond, the decay will commence at the surface of the water, or, as it is technically expressed, between wind and water, whilst all above water, and all that is constantly immersed in the water, as well as the part in the earth, will remain sound. Thus also a beam of wood let into a damp wall will begin to rot just where it enters the wall; so will wooden bannisters when they are let through the top and foot rails. In these and similar cases the rot begins externally, and its progress is inwards, and is more or less accelerated by the alternate action of wind, heat, and moisture, being *greatest* when the alternatives of exposure to wet and drought are most frequent, and *least* when constantly immersed in water, or constantly preserved in a dry atmosphere. Such we conceive to be the usual process of the *common rot* in wood, and it is evidently occasioned by alternate exposure to the vicissitudes of the weather, to moisture and dryness, to heat and cold.

If the same post be well charred or covered over with a thick coating of paint, or varnish, or tar, no such effect will be produced *externally*, the coating being sufficient to protect it against the action of the weather; but if it should happen to be a green or unseasoned piece of wood so tarred or painted, in no great length of time the wood will be found to have begun to decay *internally*, whilst the outer surface appears uninjured, but at length it will also yield to the disease. If this piece of wood had been placed in a warm cellar or close room where there is little or no circulation of air, and more particularly if the room or cellar were damp, there would be perceived, in no great length of time, a fine mouldy coating spread over its surface, of a brownish yellow or dirty white; and shortly afterwards it would be found, on examination, to resemble in its form and structure some of the beautifully ramified *algæ* or sea weeds; which in process of time would become more compact, the interstices being so completely filled up as to give to the whole mass the appearance and consistence of leather. "At first," says one writer, "its appearance is that of fine fibres running on the surface in endless ramifications, resembling the nervous fibres of leaves; presently the interstices are filled up with a spongy or leather-like substance, assuming the character of that order of cryptogamous plants distinguished by the name of *fungus*."

By Mr Wade the general symptoms of *dry rot* are thus described: "The wood at first swells; after some time it changes its colour, then emits gases which have a mouldy or musty smell. In the more advanced stages of it the mass arises, and cracks in transverse directions. Lastly, it becomes pulverulent, and forms vegetable earth; and generally in some of these stages of decay the different species of fungus are found to vegetate on the mass." (*Treatise on the Dry Rot in Timber*. By Thomas Wade.)

These appearances do not invariably take place, the surface of the diseased timber sometimes remaining unchanged, while the process of rotting is going on within; they are, however, pretty constant. But however sound the surface may be, it will appear, on examining the piece of wood, placed in a situation similar to those above mentioned, that the whole of the interior fibres are decomposed, and become a mass of dust inclosed within a thin external shell. No charring of the surface, no paint, tar, or varnish, will prevent this process from taking place,

Dry Rot. when the seeds of the dry rot exist, and are placed in a situation favourable for their growth, though they may prevent the external character of mouldiness from taking place on the surface.

Characteristic difference of the two rots. The symptomatic difference, then, between the common rot and the dry rot may perhaps be thus defined. *Common rot* is a disease in timber, occasioned by the alternations of the weather acting on its surface, and destroying its fibres externally inwards. *Dry rot* is a disease in timber, occasioned by being shut up in warm, close, and moist situations, the effect of which is to destroy its fibres by a process acting internally outwards.

Causes of the dry rot. Without stopping to inquire in what manner, and by what agency, chemical or mechanical, or both, the common rot acts on the external fibres of the wood, the effect of alternate exposure to the weather is too well known to require any further proof as to its being the immediate cause. The immediate cause of the dry rot is equally obvious; but the predisposing state of the timber to contract the disease is not so clear a problem. Accordingly, theories without end have been hatched to explain the phenomenon. A writer in a public journal, who has slightly touched on the subject, thus explains it. "It is well known," he observes, "that if a piece of green wood be laid across a fire, the air within, expanded by the heat, will drive out at each extremity a viscous fluid, possessing the property of disposing itself on the surface in reticulated filaments. The same appearance of nervous foliation is not uncommon in the intermediate spaces of the concentric layers of the *alburnum* of wood; and the core or heart of trees, and particularly of the pitch pine, after its passage in the heated hold of a ship, is often enveloped with a membranous corticle, like that which lies immediately beneath the bark. All these appearances are certain indications of the *dry rot*; and they point out, with sufficient clearness, that the *sap*, or principle of vegetation, brought into activity, is the *cause* of the disease; the *effect*, though infinitely more rapid, is the same as that of the common rot. It is still a problem in what manner this sap circulates; but there is no doubt that the tubes and cells of the *alburnum*, or sapwood, are filled with it in the spring of the year, and that they are empty in the winter; that it is organized matter, developing itself by heat in all the various forms of new bark, leaves, and branches. The stem of a tree cut down will, on the return of summer, make an effort to push out leaves; a more feeble effort of this organized sap ends in the production of *fungus* only." (*Quarterly Review*, No. 15.)

It is now, we apprehend, pretty well decided, that, like other vegetables, the fungi or mushroom tribe are propagated by seed so minute and numerous as to float about invisibly in the air, and to be carried into all manner of situations. The fine impalpable powder that issues from the common puff-ball, like a column of smoke, will give some idea of the almost inconceivable myriads of minute seeds which it incloses. Of these seeds, though myriads perish, yet others, by a concurrence of accidents, being thrown into proper situations favourable for their growth, reproduce the species. It cannot be supposed that the fibres found in the dung of animals, and particularly of the horse, known by the name of mushroom spawn, and from which our gardeners construct their mushroom beds, are generated spontaneously in the belly of the animal, but that the seeds being devoured with his food, have found that degree of warmth, moisture, and soil, favourable to the development of the future plant; and this plant which the fibres exhibit, by care and cultivation increases and grows to the perfect state of all plants, and throws out above the surface the parts of fructification which we call the mushroom. If it be asked why the dung of a cow,

which feeds on the same food with a horse, does not produce the spawn of mushrooms, the only answer to be given is, that it is not a proper *nidus* for the germination of the seed.

In the same manner may the perfect plant be produced from the seed, carried up into the longitudinal tubes of a growing tree, by the rising of the sap; though it would seem that the process of vegetation in the parasite thus lodged will not commence so long as the vital principle of the sap in the tree remains in activity. Indeed it is pretty evident, from numerous observations, that the process of fermentation is necessary to the growth of all fungi; and this may explain why in the diseased and decayed parts of a tree only are fungi found to grow whilst it is in a living state.

The sap, therefore, may be the *cause* of the *dry rot*, in as far as it is favourable to the growth of *fungi*, as it would seem to be when in a state of fermentation, though it never can by any process be convertible into this order of cryptogamous plants. But the appearance of fungi, though a frequent, is by no means a constant symptom of *dry rot*; and, therefore, Mr Bowden's definition of dry rot, with his whole doctrine, must fall to the ground. "The *nature* of *dry rot* is a *vegetable substance*," and this substance, he tells us, is fungus. Though not very happily expressed, his meaning is intelligible enough from what follows. "This secretion of nature (the juice of a tree) which was destined to appear in the form of leaves, branches, &c. being diverted from its original intention, assumes a new form from its own native energies. Vegetation commences in the various tubes of the wood, under the form of those fine fibrous shoots which have been already described (as mushroom spawn). It continues to increase in every direction, until, by an extraordinary manifestation, it happily averts the otherwise unforeseen but certain destruction of the vessel. It may confidently be asserted, therefore, that this is the primary, chief, and predisposing cause of *dry rot*; and this opinion may be further confirmed by an inquiry into the nature of the juices and fungi, and the manner in which the timber is affected." (*A Treatise on Dry Rot*, by A. Bowden.)

Mr Bowden having totally mistaken the nature of fungus, by adopting the erroneous principle of the writer in the *Quarterly Review*, labours hard to prove, and with considerable ingenuity, "that dry rot is caused by a vegetative substance, and that it is one of the species of *fungi*;" and this doctrine he illustrates in the case of *spent bark* from the tan-pits, of which he says, "when taken out and exposed to the heat of summer, the juices appear desirous of obeying the laws of nature; and being no longer capable of adding to the bulk of a tree, is satisfied with wearing the humble garb of a mushroom;" nay, so enamoured is he with the similarity of oak bark, and fungus, and *tannin*, that "an examination of the fungous coat taken from the end of a timber, would afford a strong presumption, from its exact resemblance to *leather*, that it owes its existence to no other cause than that which communicates such peculiar qualities." Into such absurdities will crude theories sometimes drive their authors.

Mr Wade has sounder notions on the nature of fungi; he knew they possessed the principle of reproduction, and that their seeds, under favourable circumstances, will vegetate; that the proper *nidus* for the reception of certain species of fungus appears to be wood in a state of progressive decomposition, or the remains of wood entirely decomposed; that, however, the effect produced by these plants and decaying timber is reciprocal, the latter furnishing food for the former, while the decomposition of the wood is accelerated by the growth of the fungus, the gaseous and soluble products being taken up by the

Dry Rot. plants, as quickly as these principles are disengaged. The whole tribe of parasitic fungi may, in fact, be considered as the wolves and tigers of the vegetable world, destroying ultimately every plant they fix upon, and most rapidly where the principle of vegetation has ceased to act, and the putrefactive fermentation of the juices has in consequence commenced.

The real efficient cause then of the dry rot, is that of the juices of the timber being brought into a state of putrefaction, occasioned generally by exposure to a moderate degree of heat and moisture in a stagnant atmosphere. "To favour this process," says Mr Wade, "as much as possible, the air and water should not be renewed, as they undergo a decomposition, which takes place very slowly." From the structure of timber being composed longitudinally of an assemblage of pipes or tubes, it is only necessary that one end of a log of wood should be placed in a damp or wet situation, to occasion the moisture to be conveyed to the opposite end by capillary attraction; and hence arises the infectious nature of the disease, which will always spread wherever the moisture finds its way; and even where there is no moisture, it will be created by the filaments of the fungi working their way through the tubes of the dry wood, and carrying it with them. Hence, also, the rapid decay in ships of war, from the great internal heat occasioned by the number of men, the moisture, and the close air. Hence, also, in houses, the *dry rot* always first appears in the lower apartments, where the floors, partitions, skirting-boards, &c. are supplied with moisture from the wet walls on the ground. In the London houses there is generally a room on the basement story, called the housekeeper's room, which is boarded, and carefully covered over with an oiled floor-cloth. In such a room the dry rot is sure to make its appearance. The wood absorbs the aqueous vapour which the oil-cloth will not allow to escape; and being assisted by the heat of the air in such apartments, the decay goes on most rapidly; and, as Mr Wade observes, "if the seed of fungus be present, the plant is developed in all the superfluity of vigour exhibited in a hot-house, where the same means are resorted to, namely, an atmosphere scientifically and artificially heated, and highly charged with aqueous vapour." Timber may, in fact, have the seeds of dry rot within it, and yet by proper treatment be kept sound for a great length of time. Thus ships laden with particular cargoes afford remarkable instances of the effects of such cargoes on their duration. The warm moisture created by a cargo of hemp is communicated to the timber, and promotes a rapid putrefaction. Mr Chapman says, that the ship *Brothers*, built at Whitby, of green timber, proceeded to Petersburg for a cargo of hemp. The next year it was found on examination that her timbers were rotten, and all the planking, excepting a thin external skin. A lading of cotton is always injurious to the ship, and even teak is affected by a cargo of pepper. The timber which is brought from America in the heated hold of a ship, is invariably covered over, on being landed, with a complete coating of fungus. It was the too general use of this timber in his majesty's ships that at one time increased the disease to such an alarming degree. Those ships, on the contrary, which are employed constantly in the coal and lime trade, are very durable, and have been known to last for a century. These effects are obviously to be ascribed to the exclusion of air in the one case from, and the free admission of it in the other to, the interior surface of the ship, assisted, in the latter instance, by the absorption of moisture, by the coals and lime, from the timbers and planking.

Prevention of dry rot. If we are arrived at the right conclusion as to the *cause of dry rot* in timber, we can be at no loss with regard to

the mode of treatment for the *prevention* of the disease. The experiments for this purpose have been very numerous, but may be classed under three general heads; desiccation or seasoning; immersion in earth, sand, or water; and impregnation with some foreign matter, which will resist putrefaction.

The most simple and common mode of preventing the decomposition of vegetable matter, is by depriving it of moisture. Various schemes have been put in practice for drying the juices in large logs of timber. Time alone will do it when the wood is placed in favourable situations, that is to say, in a dry atmosphere, and constantly exposed to a free circulation of air; but time will also produce the rot in timber when piled up in stacks in the open air, imbibing moisture from the earth, and exposed to the vicissitudes of the seasons, and the alternatives of weather; scorched at one time by the heat of the sun, at another drenched with rain, and rent and split in every possible way by the freezing of the water which has insinuated itself into the pores and crevices of the wood. It was formerly, and, indeed, till very lately, the practice to let ships of war remain on the stocks *in frame* for two, three, or four years, to *season*, as it was called; but there never was so mistaken a notion. "When a ship," says Mr Wade, "is built, exposed to the weather, the lower part forms a grand reservoir for all the rain that falls; and as the timbers in that part are placed as close together as possible, the wet escapes very slowly. Those timbers are always soaked with moisture, and, to some distance from the keel, exhibit a green appearance; their green matter, when viewed through a microscope, is found to be a beautiful and completely formed moss, which vegetates at the expense of the timber. If to season timber be only to dry it, the sooner it is dried the better; and when completely dry, it cannot too soon be employed in ship-building, when it should be kept dry. It cannot answer any end to have seven years wear out of a ship on the stocks." At length our ship-wrights are convinced of this truth, and every ship of war now building in the dock-yards has excellent roofs placed over them, with the sides open to admit a free current of air, but to exclude all moisture, as well as the rays of the sun (See DOCK-YARDS); a practice which we have tardily adopted from the Swedes and the Venetians. A new system seems also to have been adopted on the piling the timber stacks. Instead of their being placed on old, useless, and often rotten logs of timber resting on the ground, they are now insulated from the earth on stone or iron pillars; and in place of their surfaces coming in contact with each other, pieces of wood are placed between them so as to admit of a circulation of air. Nothing further appears to be wanting but to protect the tops and the ends of the stocks or piles from the effects of the weather.

Of the various modes of artificial and rapid desiccation, that of charring is perhaps the best; but it is liable to two objections, the first is, that if the surface be completely charred, it diminishes very much the strength of the timber; and, secondly, it the more readily attracts moisture. The juices of timber may be drawn off or hardened by kiln-drying; but this also disturbs the arrangement of the fibres, and deprives the wood of a great part of its strength.

The experiments made by Mr Lukin for the rapid seasoning of green oak timber, promised at one time much success, but ended in disappointment. He conceived, that if the acid and the watery particles were driven out of a piece of oak timber by some process which should prevent the surface from splitting, the fibres would be brought closer into contact, and whilst the log lost in weight it would gain in strength. With this view he

Dry Rot.

by desiccation or seasoning.

Mr Lukin's experiments for seasoning timber.

Dry Rot. buried a piece of wood in pulverized charcoal in a heated oven. The log wore a promising appearance; the surface was close and compact; it had lost in its weight and dimensions; but when divided with the saw, the fibres were discovered to have started from each other, exhibiting a piece of fine net-work, resembling the inner bark of a tree.

His next contrivance was to supply the place of the fluids driven out by heat, with some other substance of an oily or resinous nature, which, while it destroyed the principle of vegetation, should preserve the timber in a compact state. For this purpose he erected a large kiln in Woolwich dock-yard, capable of containing from two to three hundred loads of timber. At each end, on the outside, was a retort in which the saw-dust of the pitch-pine was submitted to distillation. From the heads of these retorts were iron pipes, perforated with holes like a cylinder, continued along the upper part of the kiln the whole length in the inside. By this arrangement it was expected, that while the heat of the kiln drove off the aqueous matter of the timber, the product of the saw-dust, which resembled weak oil, or rather spirit of turpentine, would drop through the holes in the tubes upon the logs, and supply its place. But before the process of transfusion was judged to be complete, an explosion took place, which proved fatal to six of the workmen, and wounded fourteen, two of whom shortly afterwards died. The explosion was like the shock of an earthquake; it demolished the wall of the dock-yard, part of which was thrown to the distance of 250 feet; an iron door, weighing 280 pounds, was driven to the distance of 230 feet, and other parts of the building were borne in the air upwards of 300 feet. The experiment was not repeated.

The bad effects of applying artificial heat to the seasoning of green timber were strongly exemplified by a practice introduced very generally into our ships of war which had exhibited indications of the dry rot, particularly in the *Queen Charlotte*. Enormous fires were made in stoves placed in various parts of the ship, and the heat led in tubes to the cavities between the timbers, &c. The consequence of which was, as might be expected, an increase of the mischief they were intended to prevent. Every part of the ship was converted into a hot-house, and every part where the seeds of fungi had been deposited began to throw out a luxuriant crop of mushrooms; and where these did not appear, the juices of the wood were thrown into a state of fermentation, and, in the course of a twelve-month, a great part of her upperworks became a mass of rottenness. After staving the powder magazines of some of the ships, there appeared under their floors, which are contiguous to much moisture, numbers of large excrescences of a leathery consistence, of the size and shape of a quart glass-decanter; and in all such parts where two surfaces of the wood were imperfectly brought into contact, were whole masses of fungi.

Winter-felled timber.

Another mode, of very ancient standing, was practised for getting rid of the juices of timber. This was supposed to be effected by felling the tree in the winter season, when the sap had descended and the vessels were empty. But by this practice the bark of the oak, so valuable in the process of tanning, was lost, as it will strip only from the wood in the spring of the year, when the sap is said to be rising. The supposed superior quality of the wood when winter-felled, and the general practice of felling oak timber at that season, may be inferred from a statute of James I. by which it is enacted, that no person or persons shall fell, or cause to be felled, any oaken trees meet to be barked, when bark is worth 2s. a cart-load (timber for the needful building and reparation of houses, ships, or mills, only excepted), but between the first day of April and last day of June, not even for the king's use, out of

barking time, except for building or repairing his majesty's houses or ships. **Dry Rot.**

The old Sovereign of the Seas is the standing example generally quoted to prove the beneficial effects of winter-felled timber. We are informed by one writer that, when taken in pieces, after forty-seven years' service, the old timber was still so hard that it was no easy matter to drive a nail into it, and all future writers have taken it for granted that this was owing to its being winter-felled. Mr Pett, however, who built her, takes no notice of any such circumstance. He merely says he was commanded by the king, on the 14th May 1635, to hasten into the north to procure the frame-timbers, plank, and trenails, for the great new ship at Woolwich. But he left his son behind to ship the moulds, provisions, and workmen, in a hired ship, to transport them to Newcastle; that the frame, as it was got ready, was sent in colliers from Newcastle and Sunderland; and that, on the 21st December, *in the same year*, the keel was laid in the dock; and in less than two years after this she was launched. Now, as it was the middle of May before Mr Pett received his majesty's commands to procure timber for this ship, and as she was on the stocks the same year, it is not very probable that the timber procured and sent in colliers from Newcastle to Woolwich was felled in the winter; much less could it have been "stripped of its bark in the spring, and felled the *second* succeeding autumn," as Mr Wade has it.

Neither is there the least proof of the old Royal William, recently broken up, when a century old, being built of winter-felled timber. The fact is, that she was rebuilt half a dozen times, and the only old and original timber remaining in her was in the lowest part of her hull, always immersed in the salt water externally, and washed with the bilge-water internally; and the wood from this part of her, when broken up, was perfectly sound, but quite black, having the appearance of being charred.

As far as experiments have been made, there is no reason to conclude that timber felled in the winter is at all more durable than that which is felled at the usual time. In the year 1793, the Hawke sloop of war was ordered to be built, one side being of timber that had been barked in the spring and felled in the winter, and the other side with timber felled at the usual time. In 1803 she was reported to be in so bad a state of rottenness, that she was ordered to be taken in pieces, when no difference whatever could be discovered in the state of the timbers of the two sides. It is said, however, in Derrak's *Memoirs of the Navy*, "that the timber had been stripped in the spring of 1787, and not felled until the autumn 1790," and this is given as an explanation of the failure. Why the barking in the spring should add to the durability of timber, is not easily conceived, if the object be to fell the timber when all the sap-vessels are empty, as, if the sap *descends* at all, which is doubtful, it might be expected to descend more freely when the bark is on than off the tree. The experiments which, we understand, are now making by the commissioners of his majesty's woods and forests, will, it is to be hoped, throw more light on a subject so vitally important to the British navy. In France, so long ago as 1669, a royal ordonnance limited the felling of timber from the 1st October to the 15th April; and the conservators of the forests directed that the trees should be felled when the "wind was at north," and "in the wane of the moon;" and we find an instruction of Bonaparte, that "as ships built of timber felled at the moment of vegetation must be liable to rapid decay, and require immediate repairs, from the effect of the *fermentation of the sap* in those pieces which had not been felled at the proper season;" the agents of the forests should abridge the time for felling naval timber, which should take place "in

Dry Rot. the decrease of the moon, from the 1st November to the 15th March."

Immersion in earth, sand, or water. The facts are so numerous and so strong in favour of the durability of timber when steeped in water or buried in earth or sand, that no doubt whatever can be entertained of the efficacy of such a practice. At Brest all the timber used in ship-building is deposited in the narrow creek of the harbour which runs through the middle of the dock-yard, and it is said that the Brest built ships never had the dry rot. The same practice prevailed at Cadiz and Carthage. Indeed there is reason to think that steeping in fresh water is a preventive of dry rot, probably by dissolving the juices of the timber. It was an ancient practice, and we believe is still followed in some parts of England, to place the timber intended for thrashing-floors in the midst of a stream of water, to *harden* it; and all the oak plants intended for the wainscoting of the old mansions were previously steeped in running water.

"I know it," says Mr Chapman, "to be the opinion of some well-informed men, whose sentiments are highly deserving of notice, that the sap of trees does not descend, but, like the arterial blood, is prevented by valves from returning; as a proof of which, it is asserted, that fresh-cut timber, if laid in a running stream, with the but-end towards the current, will have the water percolating through it, and carrying off the mucilaginous matter, but not otherwise." "There can be no doubt," he adds, "that the effect will be produced sooner in this direction than the other, and it should therefore be attended to." The reason is obvious; the extractive matter, which is the chief, though not the only, cause of putrefaction, is dissolved and driven off. The usual mode of preserving timber for masts, is to keep it immersed in water in what are called mast-locks. The mast of the Kangaroo sloop of war was dug out of the mud at the bottom of the mast-pond, at Deptford dock-yard, where it had been fifty years, and was one of the most serviceable masts in the navy. Burying timber in sand is a usual process for preserving it in warm climates. Yet, with all these facts and long experience, it was but the other day that the steeping of timber in salt water was practised in the king's dock-yards, and this originated in an accident. The *Resistance* frigate went down in Malta harbour. But as she had been reported in such a state of dry rot, or rather the surface of her timbers so covered with fungus, as to render it expedient to send her home, she was suffered to continue under water for many months. On her arrival in England it was observed that all appearance of fungus had vanished, and she remains a sound ship to this day. Yet even this fact does not seem to have attracted much attention. But when the dock-yard was removed from the northern to the southern side of Milford-haven, a few loads of timber that was covered with fungus were suffered to remain in the water for several months; and it was observed that, after being taken out and stacked in the new yard, the timber did not exhibit those appearances of dry rot which the same timber did most abundantly which had not been immersed in the salt water. This fact being reported to the navy board, it was proposed to sink one of two sister ships, the *Mersey* and the *Eden*, both alike infected with the dry rot, in Plymouth Sound. The *Eden* was the ship selected for this purpose. She remained under water for about eighteen months, and, on being raised, every trace of fungus had totally disappeared, whilst the *Mersey* was almost wholly covered with it. After remaining a year at home perfectly sound, she was sent out to the East Indies, where she now is.

It is said, and there seems to be no reason for doubting the fact, that the planks of ships near the bows, which are

Dry Rot. obliged to be boiled in water or steam in order to bend them, are never infected with the dry rot: if the water in which they are boiled be strongly impregnated with salt, the effects would probably be more durable and decisive.

In a lecture read by Mr Ogg, a salt refiner, to the Plymouth Institution, on the prevention and cure of dry rot in ships of war, common salt is strongly recommended, for its cheapness, its wholesomeness, and its easy application; but he proposes a saturated solution of salt, in which he would steep not only single logs or planks, but the whole frame of a ship, or even the ship itself. "Let every ship in the navy," says the salt refiner, "be immersed a sufficient time in this fluid, and let every new ship be prepared in the same way, and dry rot would be heard of no more. But how is this to be accomplished? I answer, provide a dock or docks sufficiently capacious to receive five, ten, or twenty ships, and the work is done." As common sea-water will answer the purpose equally well, the apparatus of extensive docks and water saturated with salt are wholly unnecessary. But Mr Ogg, like Mr Bowden, appears to mistake the real cause of dry rot. "I affirm," says he, "that dry rot is occasioned by the vegetative principle; brine will destroy this principle; then sink the ship in brine." The experiments in the case of the *Resistance* and the *Eden* show that brine is not necessary.

The Dutch having observed that their busses, in which the herrings were caught and stowed away in pickle, lasted longer than any other craft, adopted the practice of filling up the vacancies between the timbers and planks of ships with salt, and of boring holes in the large timbers and cramming them full of salt. The Americans also found, that the ships employed in carrying out salt for their fisheries and domestic purposes were the most durable; and both they and the Dutch are glad to get a cargo of salt into a new ship, as the surest means of preserving her. The carpenter of the *Franklin*, an American seventy-four gun ship, when at Spithead, told some of her visitors, that at the junction of the beams, and at the but-ends of the timbers, pieces were cut, and the hollow part filled with salt, and covered over with felt, for the purpose of preserving those parts where two surfaces are imperfectly brought together, from the dry rot, where it is always most prevalent.

There are, however, very serious objections to the immersion of ships in a strong solution of salt, and the practice of inserting salt in the vacant space between the timbers, which may not, perhaps, apply with equal force to their immersion in sea-water. It is observed by a writer in the *Quarterly Review* for October 1814, that "the attraction for moisture which salts and acids possess, would keep the whole interior of the ship dripping wet; which would not only destroy the ship with the wet rot, but the ship's company also, whose health, experience has proved, is best preserved by keeping the ship as dry as possible; and thus the remedy would be worse than the disease." These bad effects have unquestionably been experienced, the muriate of magnesia, which exists in sea-water, being one of the most deliquescent salts; but whether the abstraction of moisture from the atmosphere be of long duration, is a fact which remains to be proved. In corroboration of the injurious effects above described, Mr Strange, in his *Evidences*, observes, "that the practice at Venice of the fresh cut timber being thrown into salt water prevents its ever becoming dry in the ships, and that the salt water rusted and corroded the iron bolts." Mr Chapman also observes that "the *Florida*, a twenty gun ship, taken from the Americans, and subsequently commissioned in the British service, had been salt-seasoned; and the result was, that in damp weather every thing be-

Dry Rot. came moist, the iron work was rusted, and the health of the crew was impaired; in fine," he adds, "vessels so circumstanced are perfect hygrometers; being as sensible to changes of the moisture in the atmosphere as lumps of rock salt, or slips of fuci, or the plaster of inside walls where sea-sand has been used."

Mr Chapman, however, is of opinion, that vessels impregnated with bay-salt, or the large grained salt of Limestone or of Liverpool (being pure muriate of soda, without admixture with the bitter deliquescent salts), will possess decided advantages, as would also vessels laden with saltpetre, if it has been dispersed among their timbers; and Mr Ogg sees no difficulty in refining salts so as to deprive it of its deliquescent quality. But if a very weak solution of salt, or even fresh water, shall be found to answer the purpose, the objection against immersing timber in sea-water seems to be got rid of. That it will immediately destroy all vegetable life in the delicate fibres of the fungus, and also prevent its future growth, is quite clear; and if it shall be found to prevent also the putrefactive process, it may be considered as the most advisable way to prepare timber for all purposes of house carpentry and ship-building.

Impregnation of timber with foreign substances. A great variety of substances besides common salt, indeed almost any salt or acid, will destroy and prevent the growth of fungus. Sir Humphry Davy recommends a weak solution of the corrosive sublimate as the most efficient. A solution of sulphate of iron or copperas is much used in Sweden for hardening and preserving wood for wheel-carriages, &c. It is first boiled in this solution for three or four hours, and then kept in a warm place to dry, by which process it is said to become so hard and compact that moisture cannot penetrate it. "The wooden vessels," says Mr Chapman, "in which the sulpho-ferruginous solution is finally placed for the copperas to crystallize, become exceedingly hard, and not subject to decay." A solution of alum has been recommended; but Mr Chapman seems to think that its earthy basis would become a nidus of putrefaction. The wood, however, which is used about alum works, becomes hard and durable, and resists fire in an extraordinary manner. All timber, in fact, when completely saturated with saline matter, is more or less indestructible, and absolutely incombustible. A solution of arsenic has not been found to prevent the dry rot. With regard to the impregnation of oils there are various opinions, some thinking them beneficial and others injurious to the durability of timber. It is known, however, that ships in the Greenland trade have their timbers and planks preserved as high up as they are impregnated with whale oil from the blubber; and Mr Chapman says, that one of the masters of a Greenland ship having payed her upperworks with twelve or more successive coats with whale oil in hot weather, they became covered with a thin varnish, much harder and more compact than if filled with successive coats of turpentine. Resinous substances, however, are probably better than oil.

After a variety of experiments and sensible observations, Mr Chapman sums up the three great operations by which timber may be brought to resist the tendency to dry rot.

1. To deprive the timber of its mucilage, which is very liable to fermentation.
2. To impregnate timber with any strongly antiseptic and non-deliquescent matter.
3. To dry timber progressively by the sun and wind, or by the latter alone; and then to close its pores completely with any substance impervious to air and moisture, and at the same time highly repellant to putrescency.

Mr Wade recommends the impregnation of timber with sulphates of copper, zinc, or iron, rejecting deliquescent salts, as they corrode metals, and would destroy the bolts

and metal fastenings of a ship. He observes, that timber impregnated with saline matter is no longer capable of fermentation, and that, of course, the gases necessary for the nutriment of fungi are not evolved. Selenite is recommended as being insoluble, or nearly so, and not liable to any alteration in the ordinary temperature of the atmosphere; but all salts, he observes, composed of barytes, should be rejected, because, though they are plentiful, cheap, and have some qualities eminently fitting them to be employed for this purpose, yet they are, without any exception, very poisonous.

From all experiments that have been made, it appears that the most effectual method of preventing the dry rot, and of giving durability to timber, is that of depriving the sap of its mucilage, more especially in the alburnum, where it most abounds; for though seasoning in the dry way will coagulate and harden the extractive matter of timber, yet when exposed to heat, moisture, and a stagnant air, the process of putrefaction will commence, and all the symptoms of dry rot will speedily make their appearance. It will be preferable, therefore, that such timber as is likely to be exposed to the vicissitudes of weather, should be seasoned by immersion or impregnation, rather than by the dry way.

In this disease, as in those incident to animal life, prevention is much easier than cure. In fact, there is no other cure for the part affected than excision, and the sooner it is done the better, as the disease spreads most rapidly when fungi are propagated, throwing their minute fibres into the tubes of the contiguous sound wood, and producing that moisture which is a condition absolutely necessary to the putrefactive process. If, however, the fibre of the wood is still sound, and the roots of the fungi extend not beyond the alburnum near to the surface, immersion in sea water, as in cases of the Resistance and the Eden, or impregnation with some of the solutions above mentioned, may stop the progress of the disease; but the only safe cure, we apprehend, is that of cutting out the infected part. The sinking of the Royal George at her moorings has not been the means of preserving her timbers. On being visited in the diving-bell, her oaken sides were broken down into a confused mass of timber and black mud; having, no doubt, been too far gone in decay when the fatal accident happened; but her fir deck appeared as sound as the day when she sunk.

It is a great mistake to suppose that the ancients were unacquainted with the dry rot, or premature decay of timber. Pliny has a number of valuable observations on the preservation of timber, and on its decay occasioned by the juices; and, among other things, recommends that a tree should be cut to the heart all round, in order to let the juices escape, and that it should not be felled until the whole had run out. He knew that the sappy part of oak was more subject to rot, and advised that it should be cut away in squaring. He knew, too, that resinous and oleaginous matter in wood preserved it; observing, that the more odoriferous a piece of timber is, the more durable. He knew that much depended on the close texture of timber, and that box, ebony, cypress, and cedar, might almost be considered as indestructible. We also know that cedar, teak, and mahogany, are very durable woods.

The felling of timber while young and full of vigour, making use of the sap-wood or alburnum, and applying it to ships and buildings in an unseasoned state, have no doubt contributed to make the disease of dry rot infinitely more common and extensive than it was in former times, when our ships were "hearts of oak," and when in our large mansions the wind was suffered to blow freely through them, and a current of air to circulate through the wide space left between the pannelled wainscot and the wall.

Dry Rot.

Cure of the dry rot.

Miscellaneous observations.

Dry Rot In those old mansions which yet remain, and in the ancient cathedrals and churches, we find nothing like the dry-rot, though perhaps

.....perforated sore
And drill'd in holes, the solid oak is found
By worms voracious eaten through and through.

Numerous examples of the extraordinary duration of timber may be produced, both from complete desiccation and exposure to the air, and from the complete exclusion of air and immersion in earth or water. Without adducing the surturbrandt of Iceland, covered with several strata of solid rock, or the logs of wood dug out of peat-moss, the antiquity of which is mere conjecture, we may instance the mummy cases of Egypt as being in all probability the most ancient timber in existence that has been worked by the hand of man. When Belzoni entered the splendid tomb of the kings of Thebes, in which was the transparent sarcophagus of gypsum, he found two human figures larger than life sculptured in wood, in as good preservation as if it had been worked in his own time; but the sockets of the eye, which had been copper, were entirely wasted away. We are told by Pliny, that the image of Diana at Ephesus, supposed to be of ebony, remained entire and unchanged, though the temple itself was ruined and rebuilt seven times. He adds that, in his own time, the image of Jupiter in the capitol, made of cypress wood, was still fresh and beautiful, though set up in the year after the foundation of Rome 551, nearly three hundred years before. He further says that there was a temple of Apollo at Utica, the timbers of which, being of Numidian cedar, are said to have stood 1188 years. The roof of Westminster Hall, which is constructed of chestnut, has stood for more than three hundred years, and is probably better now than when newly erected. Similar instances

of the long duration of timber have occurred in situations where the atmospheric air has been excluded. In the Leverian Museum was a post said to be dug out of Fleet Ditch, charred at the lower end, having the name of Julius Cæsar cut into it. The foundation on which the stone piers of London Bridge are laid consist of huge piles of timber driven close to one another, on the top of which is a floor of planks ten inches thick, strongly bolted together; on these the stone piers rest, at above nine feet above the bed of the river, and, at low water, may be seen or felt at a very few inches below the surface. These piles have been driven upwards of six hundred years, and, from the solidity of the superincumbent weight, it may be concluded that they are perfectly sound. In the old city wall of London, timber is frequently dug out as sound and perfect as when first deposited there. As the last instance of the extraordinary preservation of timber, we may mention, that, in digging away the foundation of the Old Savoy Palace, which was built about six hundred and fifty years ago, the whole of the piles, consisting of oak, elm, beech, and chestnut, were found in a state of perfect soundness, without the least appearance of rottenness in any part of them, and the plank which covered the pile-heads was equally sound. Some of the beech, however, after being exposed a few weeks to the air, but under cover, had a coating of fungus spread over the surface; which affords a striking proof of the immense length of time that the seeds of this parasite will remain dormant, without parting with the principle of vegetable life, which is called into activity from the moment that they are deposited in a situation favourable to their growth. In this instance we have only to suppose that the indurated juices of the wood became dissolved by its exposure to the moist atmosphere, and the phenomenon of fungous vegetation is capable of receiving a satisfactory explanation. (M.)

Dry Rot
||
Dublin.

DSJABBE TAR, a small island in the Red Sea, pertaining to Arabia, about forty miles west-south-west of Loheia. Long. 41. 35. E. Lat. 15. 32. N.

DSJABEL, a small island in the Red Sea, about twenty-four miles from the coast of Arabia. Long. 43. 34. E. Lat. 15. 32. N.

DSJAR, a sea-port of Arabia, in the province of Hedsjaz, situated on the coast of the Red Sea, supposed to be the Eziongeber of the Scriptures. It is sixty-seven miles west of Medina.

DSJEBI, a walled town and district of Arabia, in the country of Yemen, with a citadel. It is the residence of a chief. The surrounding country is mountainous, and produces coffee. It is fifty-six miles east of Hodeida. Long. 43. 40. E. Lat. 14. 44. N.

DSJOBLA, a town of Arabia, in Yemen. The streets are paved, and the houses high and well built. It contains 600 houses. Part of the population consists of Jews, who inhabit a particular quarter without the town. It is twenty-two miles north of Taas, and sixty miles north-east of Mocha.

DSJOF, an extensive province of Arabia, in the country of Yemen, consisting chiefly of sandy plains and deserts. It is celebrated for its horses and camels, which are exported in great numbers; and Mareb, its principal town, sends salt to Sana.

DUBLIN, the metropolitan county of Ireland, in the province of Leinster, is bounded on the north by the county of Meath, on the east by the Irish Sea, on the south by the county of Wicklow, and on the west by those of Kildare and Meath. It is the smallest county in Ireland except Louth and Carlow, containing 248,631 acres, or 388½

square miles, of which 237,819 acres are cultivable, the remaining 10,812 being bog or mountain. Its greatest length from north to south is thirty miles, its greatest breadth from west to east twenty-three. A small portion, detached from the rest, lies at a distance of between twenty-four and thirty miles from the city, and is surrounded by the counties of Wicklow and Kildare. In Ptolemy's geography it is stated to be inhabited by the tribe of the Eblani. At the period of the English invasion, and for some time previously to that event, the city of Dublin and all the adjoining districts were in the possession of the Danes, from whom the tract to the north of the city was called Fingal, or the country of the White Strangers, a name given by the natives to those invaders on account of their fair hair and complexion; and that on the south was called Harold's country, which name it retained long after it fell into the hands of the English. Of the nine baronies into which the county is divided, those of Balrothery, Castleknock, Coolock, and Nethercross, are on the north of the Liffey; those of Donore, Newcastle, Rathdown, St Sepulchre, and Uppercross, are on the south of the same river. The baronies are subdivided into seventy-eight parishes, besides four parts of parishes, the remainders of which are in the city. The ultimate subdivision of townlands is retained here, as in other counties, but is little used, because the county is divided in a different manner for the purpose of collecting the local taxes; the whole surface being considered as broken up into 114,657 parts, a proportionate number of which is allocated to each barony.

The northern portion of the county is flat, and the soil good, particularly in the parts bordering on Meath; but,

Dublin. on the southern side, the land soon rises into elevations of considerable height, which extend into the adjoining county of Wicklow. Of these, Kippure Head is 2527 feet above the level of the sea, and the Three Rock Mountain 1585 feet. The soil in these mountains is very poor, affording no encouragement for tillage, being chiefly covered with heath, except where a subsidence in the ground affords a nucleus for the formation of bog, with which about two thousand acres are covered. There are also a few small tracts of bog in the northern part of the county. This mountain district is well adapted for timber, to the growth of which much attention has lately been paid, and the labours of the improvers are already rewarded by some fine plantations equally ornamental and profitable. This range of mountain ground produces a very striking effect on the traveller proceeding to the metropolis from Wicklow county. On arriving at its brow, the whole of the plain, watered by the Liffey, studded with villas, and enriched with groups of trees, spreads itself out before him, in the midst of which may be seen the spires and domes of the city rising through the dusky canopy of smoke that envelopes them; whilst beyond, the beautiful expanse of Dublin Bay, backed by the Hill of Howth, and the islands of Lambay and Ireland's Eye, and still more remote the peaked summit of Slieve Donard towering above them all on the horizon's verge, present a view of highly improved nature not often to be surpassed.

Though by much the greater part of the soil is inclined to clay, it is not of the deep and tenacious character so common in England; for scarcely any part is without a mixture of gravel; and due search will generally discover limestone or other beneficial substrata at no very great depth, attended with the further advantage, that the operation of draining generally raises a sufficiency of gravel to manure the whole surface. The position of the ground, usually more or less sloping, affords peculiar facilities for drainage; and the circumstance of a great city in a central position furnishes large quantities of ashes and other species of refuse well calculated to conquer the natural stubbornness of such soils. Along the coast between Howth and Balbriggan are salt marshes, but not of any extent. The only stream deserving the name of river is the Liffey, which, rising in the table-land of Wicklow, and precipitating itself over the fine cataract of Polaphuca, near which it is joined by the King's River, traverses the level county of Kildare; on leaving which it rushes over another elevated ledge of rocks called the Salmon-leap at Leixlip, after which it resumes its tranquil character, and, passing through the centre of Dublin city, discharges itself into the bay of the same name. It is joined at its mouth by the Dodder, a mountain stream which, though too insignificant to afford depth sufficient for the smallest boat, supplies water for several mills of various description during its short course from Kippure Hill to the sea. The other streams, which are numerous, have all an eastern direction, but are too small to be noticed, except the Delvan and Braywater, and these only as forming the county boundaries to the north and south.

Dublin Bay, much admired by strangers who arrive by sea, and deemed inferior only to the Bay of Naples in scenic grandeur, is very unsafe for shipping. It is five and a half miles wide at the entrance between the Point of Howth and Dalkey Island, and six miles deep to the mouth of the Liffey at Ringsend. It is dangerous to navigators, being exposed to a heavy sea from the east. To guard against wreck, a lighthouse has been erected at the Point or Bailey of Howth, another on a pier projecting from the mouth of the Liffey, and a third on the Kish Bank, outside the bay. Two artificial harbours have also been constructed, the smaller at Howth, occupying an area

of fifty acres, at an expense of L.300,000. It is now little used. The other is at Dunleary or Kingstown, formed by two immense moles, including a space of 250 acres, from three to four fathoms deep at low water. Its entrance is marked by a revolving light. A small obelisk, surmounted by a regal crown, has been erected close to the pier, to point out the place where King George IV. took his departure from Dublin in 1821. The place of his previous landing at Howth has not been marked by any similar memorial. A rail-road from Kingstown to Dublin has been commenced. The only other harbours are those of Balbriggan and Skerries, to the north of Howth. Each of them has been improved by artificial piers, but both are dry at low water. The former admits vessels of some size, and enjoys a small coasting trade. The latter is little more than a fishing station. The sailors are considered as among the most skilful and hardy on the eastern coast. They fish in decked wherries, manned by a full crew of twelve or fourteen hands, all of whom have a share in the boat, and consequently an interest in the capture of fish.

The largest island on the coast is Lambay, to the north of Howth, comprehending somewhat more than 650 acres. A castle on it serves as the occasional residence of the proprietor. Shell-fish of every description is taken in abundance on the shore, and during the summer season it is frequently visited by fishing and pleasure parties from Dublin. To the north are the Skerries, consisting of the islets of Innispatrick, Colt, Shenex, and Red Island, the last named of which is connected to the mainland by the pier already noticed. Innispatrick is noted in the ecclesiastical annals of the country as being the place on which St Patrick first landed, and where he built a church. Between Lambay and Howth is Ireland's Eye, or, as it should be named, Hirlandsie, a craggy rock, comprehending about thirty acres, and supposed by some geologists to be an insulated portion of the neighbouring peninsula. At the southern extremity of Dublin Bay is Dalkey Island, formerly called St Begnet's or Bennet's, and at present remarkable only for a martello tower erected on it. The channel which separates it from the mainland occasionally affords a good roadstead for shipping. It has been considered by some engineers as the most appropriate situation on which the public money could be laid out on a safety harbour with the greatest economy, and the most probable return of advantage to the trade of Dublin.

The greater part of the county is the eastern extremity of the great bed of floetz limestone that extends over the middle of the island, widening as it spreads westward. It rises in its southern part into a range of mountains, which forms the verge of an elevated district, extending thence for more than thirty miles to the south. Through this latter tract a large body of granite passes in a south-western direction, bounded on its eastern and western sides by incumbent rocks of great variety of structure and relations. Within the portion of this district included in the county of Dublin, and distinguished by its beautiful scenery, are veins of lead ore at Dalkey and near the Scalp. The country near Bray presents, within a small space, an instructive series of rocks; and at Killiney, schistose beds are to be seen to a considerable extent, reposing on granite. Near Booterstown, in Dublin Bay, a mass of compact limestone is visible, within a few fathoms of the granite. The calp of Kirwan, a variety of limestone, is the prevailing rock in the immediate vicinity of Dublin, and is much used for building. The brown spar of Jameson is found in veins in the quarries of Dolphinsbarn, and beds of magnesia limestone in the Dodder. Petrifications abound in many parts of the limestone country. In the peninsula of Howth gray ore of manganese, with brown iron stone, and brown iron ore, have been obtained in quan-

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Dublin. tities; and a variety of the earthy black cobalt of Werner has been found on the side of the hill, forming a crust of a rich blue colour, lining the fissures of a rock of clay slate nearly approaching to whet slate; a mineral found in great abundance at Killiney, and for some time considered as a nondescript species, is to be referred to the andalusite. It appears thickly on the surface of beds of mica slate, and seems to abound also imbedded in the substance of the same rock. White clay, potters' clay, and yellow and brown ochre, are found in Howth, and at Rush and Skerries. Indications of lead show themselves at the commons of Kilmainham, near Castleknock, at Clontarf, and near Dalkey and Killiney. The copper mines at Lough Shinney have been badly wrought; the ore was of a rich quality, and apparently derived from contemporaneous veins of quartz of uncertain extent.

At Lucan, to the west of Dublin, there is a spring strongly impregnated with iron and sulphur; another exists at Goldenbridge, near Kilmainham; and both are much frequented by invalids. Chalybeate springs have been discovered in various places in the vicinity of Dublin city.

The population of the county, taken detached from that of the city, has until lately been calculated on very uncertain data, and the results are consequently very unsatisfactory. De Burgho, in his *Hibernia Dominicana*, published in 1762, estimates it at 211,674, including the city; but this is evidently too high. Beaufort, in 1792, estimates it at 64,000, which is probably too low. The subsequent parliamentary returns give the following results: In 1812 it amounted to 132,000, in 1821 to 150,011, in 1831 to 183,042.

The state of education has been ascertained by parliamentary returns to be as follows:

	Boys.	Girls.	Sex not ascertained.	Total.
1821,	15,237	9235	...	23,425
1824-6,	17,989	14,524	495	33,008

The numbers in the latter return are thus classified according to the religious persuasion and pecuniary capabilities of the pupils: Of Roman Catholics, 20,440; of the established church, 10,372; of dissenters, 465; of those whose religious persuasion was not ascertained, 1731. As to the mode of payments, there are stated to be 730 schools, fifty-four of which, containing 3301 pupils, are supported by grants of public money; 140 schools, containing 13,467 pupils, by voluntary contributions; while those in the remaining 535 schools, amounting to 16,605 pupils, are supported wholly by the fees paid for education by the parents and friends of the children.

Previously to the union the county returned ten representatives to parliament; two for the county, two for the city, two for the university, and two for each of the boroughs of Swords and Newcastle. The number was reduced to five by the act of union; the members for both boroughs being struck off, and one withdrawn from the university, but this latter has been restored to it by the reform act. The constituency at various periods, before, during, and since the alterations made in consequence of the Catholic relief bill, presents the following results:—

	L.100.	L.50.	L.20.	L.10.	40s.	Total.
1st Jan. 1829,	...	1092	434	...	2490	4016
1st Jan. 1830,	...	1135	465	49	...	1649
1st May 1831,	...	1223	496	109	...	1828
1st Jan. 1833,	...	674	592	759	...	2025

From this table it appears that, though the constituency has been increased by the reform act beyond what it had been reduced to by the disfranchisement of the forty-shilling freeholders, it still amounts to but one half of what it had been before that period. The county court, in which the elections are held, the county business transacted, and

Dublin. the records kept, is at Kilmainham, a suburb of Dublin. When opened for legal proceedings, the chairman of the county, who is a barrister, nominated by the crown, but not allowed to practise as such, presides. In many points the jurisdiction of the city police, of which an account will be given in the description of the city, extends throughout a great part of the county.

The manners, appearance, and dress of the lower classes differ less from what may be considered as being peculiarly characteristic of the rural population of remoter districts, than might be expected in the vicinity of a large metropolis. Even in the immediate neighbourhood of the city are to be seen groups of cabins, exhibiting, both in their external appearance and in the dress and manners of their inmates, much to remind the observer of the peasantry of the interior. The farms are in general small. Near Dublin, particularly on the southern side, they are chiefly villas, with land attached to them, more for ornament and convenience than for agricultural profit. The rents are proportionally high, being rated rather from local circumstances than from the quality of the soil. Tillage, though not in a backward state, is by no means so far advanced as might be expected. Dairy farms, for the supply of the city with milk and butter, are much run upon. Vegetable gardens are numerous, particularly in the superior soil of the northern outlets of Dublin. Grazing farms for black cattle and horses are also frequent. The fences are generally of white thorn, close, and well kept. Manure of every kind is abundant; blue, brown, and white marl is extracted in many parts; fine shelly sand is drawn from the flat shores; and coal ashes, night soil, and other refuse of the metropolis, furnish abundant supplies of this important material, varying in quality according to the taste of the farmer and the peculiarity of the soil. The waste from gas works has also been beneficially used for the same purpose, when mixed with other substances.

Manufactures are carried on, but in a limited manner, in the country parts. At Balbriggan is a stocking manufactory of some extent. The Dodder furnishes sites for several paper-mills, a distillery, and some cotton and woollen factories. There is also an extensive woollen factory at Kilmainham, and a few smaller ones in the liberties of Dublin.

This county is distinguished for the superior quality of its eels; they are found in great abundance in Tullagheen river, where they are called silver eels, from their clear white colour, supposed to be derived from the superior purity of the water they inhabit. The mud eels are of a yellow tinge and less pleasant flavour. Sand eels are found in plenty along the coast. At Rush and Skerries the curing of cod and ling is carried on. Sturgeon has at times appeared in Dublin Bay; and the sprat is found in the Liffey, in which river there is also a profitable salmon fishery. There are oyster beds at Howth, Lambay, and Poolbeg; the fish was originally brought from Arklow. Porpoises are frequent on the Dublin coast. The principal supply of fish for the Dublin market is from Skerries and Howth.

Among the amusements of the lower classes, horse-racing and steeple chases are peculiarly attractive. Latterly a new direction has been given to the public taste for manly diversions by means of the new harbour at Kingstown. A regatta is annually held there, where prizes are distributed, by a club of noblemen and gentlemen, for races of yachts and row-boats. The annual assemblages occasioned thereby every summer give rise to much festivity in the neighbourhood. Formerly a club devoted to conviviality used to assemble once a year on the island of Dalkey, where, during the period of the meeting, a king of the island, elected for his superior qualifications, from among his boon companions, and who therefore might just-

Dublin. ly be styled the king of good fellows, held his mimic court, with all the appendages of burlesque royalty. But, during the period subsequent to the first French revolution, the love of frolic, as was to have been expected, took a democratic bent. The good king of Dalkey was formally deposed. The events which followed were ill adapted for the indulgence of this species of sociability; the annual meetings were discontinued, and have never since been revived. At Finglas, a village to the north of Dublin, Mayday is celebrated by amusements of a different kind, yet not less grotesque, consisting of races of asses, men in sacks, pigs with soaped tails, and other feats of waggish skill and eccentricity. But of all places calculated to exhibit the peculiarities of Irish frolic in its wildest mood, Donnybrook bears the palm. A fair is held here annually in August, ostensibly for the sale of cattle; and there is generally a good show at it, particularly of horses; but its leading attraction is the great variety of diversions of every kind likely to draw to it the artizans and lower classes of Dublin. The festivities are kept up night and day for a week, and sometimes for a fortnight. Latterly, however, the irregularities it gave rise to have induced the civic authorities to restrain its duration, and it is consequently on the decline as a place of public amusement.

This county reckons three round towers among its antiquities; one at Clondalkin in a high state of preservation; another at Swords, where also is the remains of a large monastic institution; a third at Lusk, forming one of the angles of the steeple. The church of St Doulaghs is worthy of note for the extreme antiquity of its architecture; it is covered with a double stone roof. A fine cromlech is still preserved near Cabinteely. The remains of a stone chair, and a rudely sculptured piece of granite, mark the former existence of an ancient temple near Killiney. At Old Connaught is a cross of considerable antiquity formed of granite. Its shaft is surmounted by a circle, on which the crucifixion is rudely sculptured. Among modern monuments may be noticed the Wellington memorial in the park; obelisks at Stiltorgan and on Killiney Hill, built by the proprietors of those demesnes, to supply employment during seasons of scarcity; and another also near Killiney, on the spot where the young Duke of Dorset was killed by a fall from his horse. This county can boast of no large town except the capital. Balbriggan, the second in size, contains a population of only 3016 souls.

DUBLIN, the capital city of Ireland, and the second in the united kingdom in magnitude and population, is situated nearly in the middle of the county of the same name, and at the mouth of the river Liffey. It was known as a place of importance as early as the time of Ptolemy, who notices it by the name of Eblana. By the Irish it is called Athcliath or Bally-Ath-Cliath, signifying the town of hurdles, and by that of Drom-Col-Choil, or the hill of the hazel wood, which latter name is supposed to have been more peculiarly applied to the hill on which the castle of Dublin now stands, a conjecture confirmed by the fact, that on removing the walls of the old castle chapel in 1806, they were found to have been laid on piles of hazel wood. Its modern name is said to be compounded of the Irish words Dubh and Linn, the black water or black bath, from the dark appearance of the river in the marshes near its mouth.

The city was in possession of the Ostmen at the close of the fifth century, who maintained themselves in it, and in the adjoining district, until the arrival of the English, by whom it was taken after a stubborn resistance, and Asculph Mactorkill, the Danish governor, made prisoner and put to death by the conquerors. When Henry II. landed in Ireland he made it his place of residence, and constructed a palace of wattles "after the country manner," in which

he received the native chieftains who came to do homage to him. It is also said that he held a parliament here, but no records of it are now in existence. Before his departure for England he invited over a colony from Bristol, encouraged them to settle by the grant of a charter, the original of which is still to be seen in the archives of the city, conferring on them all the rights of citizens of Bristol. King John visited the city during his father's lifetime, as Earl of Morton, and again in 1210, after he came to the throne, when upwards of twenty Irish chieftains swore allegiance to him, he on his part covenanting to establish the English laws and customs throughout the island, and consequently opening courts of justice according to the forms of the law of England. In 1216 Magna Charta was granted to the Irish by Henry III.; a copy of it is to be found in the Red Book of the Exchequer. In 1217 the city was granted to the citizens at 200 marks per annum. In 1227 the same monarch confirmed the charter of John, fixing the city's boundaries and the jurisdiction of its magistrates. During the invasion of Ireland by Edward Bruce, in the commencement of the reign of Edward II. some of the suburbs were burnt to prevent them from falling into his hands when besieging the city. Richard II. erected it into a marquisate for his favourite Robert de Vere, whom he also created Duke of Ireland. The same king visited it twice, first in 1394, on which occasion he bestowed the honour of knighthood on four Irish princes in Christ Church; and again in 1399, when his continuance there was cut short by the rebellion of the Duke of Lancaster. In 1404 the statutes of Kilkenny and Dublin were confirmed in a parliament held in the city by the Earl of Ormond. The attachment of the people of Dublin to the house of York induced them to acknowledge Lambert Simnel, who was crowned in Christ Church in 1486. The rash rebellion of Lord Thomas Fitzgerald, son of the Earl of Kildare, seriously endangered the city in 1534. On his appearing before the walls with a powerful force, the citizens were induced through fear to give admission to a detachment of his troops to besiege the castle; but, on hearing that he had met with a reverse in another quarter, they suddenly closed their gates and detained his men as prisoners. He then attacked the city itself; but finding it too strong to be seized by a *coup de main*, he raised the siege on condition of having his captured soldiers exchanged for the children of some of the principal citizens who had fallen into his hands. At the breaking out of the civil war in 1641, a conspiracy to seize on Dublin Castle was detected on the eve of the day in which it was to be effected, and the city was thus preserved for the king's party. In 1646 it was besieged by the Irish army, but without success, as the Marquis of Ormond, then lord-lieutenant, had put it into a respectable state of defence, in doing which he was aided by his wife and the other ladies of distinction residing there, who assisted in carrying baskets of earth to repair the fortifications. He was, however, compelled to surrender it on conditions the next year to Colonel Jones, commander of the parliamentary forces; and in 1649 he was totally defeated at Rathmenes in an attempt to recover possession of it. The same year Oliver Cromwell landed in Dublin, and proceeded thence on his career of conquest, which commenced with the capture of Drogheda by storm, and the subsequent massacre of its inhabitants. On the resignation of Richard Cromwell in 1659, the castle was surprised by a party of officers favourable to the royal cause; and though immediately retaken by Sir Hardress Waller, it was forced to surrender again in a few days. When James II. landed in Ireland in 1688, to assert his right to the British throne, he held a parliament in Dublin, and erected a mint there, in which a large quantity of base money was coined, in

Dublin. the hope of relieving his financial difficulties. On his return thither, after the defeat of the Boyne, it is said that he refused to listen to a proposal to burn the city, in order to check his adversary's pursuit. Such a step was, however, as unnecessary as it would have been flagitious; for William advanced by slow marches, and on his arrival encamped at Finglas, and did not enter the city till the ensuing day, when he went in state to St Patrick's Cathedral to return thanks for his victory. In 1783 a convention of delegates from all the volunteer corps in Ireland assembled in Dublin for the purpose of procuring a reform in parliament; but the House of Commons refused to entertain the proposition, and the convention separated without coming to any practical result. In May 1798 the explosion of a conspiracy planned by the united Irishmen to seize the city was prevented by the capture of Lord Edward Fitzgerald and some of the other leaders. In 1800 the act of union between Great Britain and Ireland was passed in both parliaments, and on the 1st January following the imperial standard of the united kingdom was hoisted on Dublin Castle. In 1803 another insurrection, headed by Robert Emmett, a young barrister of great talents, broke out, but was immediately quelled with the loss of some lives in the tumult, and the death of its leaders on the scaffold. The only remarkable event in which Dublin was more peculiarly interested since that event, was the visit of George IV. to Ireland in 1821, when he spent several days in inspecting its public institutions and receiving the congratulations of his Irish subjects; and on quitting it left behind him a letter expressive of his feelings on the reception he had met with, and of his wishes for their welfare and prosperity.

The site of the city was long confined to the hill on the south side of the river of which High Street forms the crest, and the castle the eastern declivity. The walls, which may still be traced on maps, though scarcely a vestige of them now remains, did not exceed a mile in length. From the north tower of the castle they were carried over Cork Hill, near which was an entrance called Dame's Gate, looking towards Hoggin's, now College Green. Near Essex Bridge was another entrance called Essex Gate, erected on the site of Isod's Tower. The wall was then carried westwards along the course of the river to the end of Fishamble Street. Here stood Fyan's Castle, sometimes used as a state prison. Thence it continued along Wood Quay to Winetavern Street, where was another castle; and, still continuing parallel to the river, it joined a castle through which was one of the principal entrances, opposite to Bridge Street. Thence it was carried to New Row, and up the hill to Cutpurse Row, at the end of which was Newgate, also used as a prison. From Corn Market it passed along the rear of Back Lane to Nicholas Gate, thence between Ross Lane and Bride's Alley to Pool Gate, afterwards Werburgh Gate, and thence in a straight line till it joined the castle at Birmingham Tower. The part of the city now called Dame Street and College Green was a low swampy plot, subject to inundations of the river, to the north of which were a Danish settlement, now called Oxmantown, a corruption from Ostmen's Town, and the extensive monastery of St Mary's, with its appendage the friary of St Saviour. The only passage across the river by land was by a bridge at the end of Bridge Street, formerly called Old Bridge, Dublin Bridge, and for some time Friars' Bridge. It was taken down in 1815, and its place supplied by an elegant new erection of three arches called Whitworth Bridge. In sinking for a foundation the traces of two or three former ones were discovered, one of them of excellent workmanship, supposed to have been the original, laid in the reign of John, and which, having been swept away in 1385, was replaced by the Dominican

friars, who repaid themselves by a toll. All the other monastic buildings were on the south side of the river. These were, the two cathedrals, to be described more minutely hereafter; the abbey of St Thomas the Martyr, since called Thomas Court; the priory of All Hallows, now Trinity College; the monastery of St Francis in Francis Street; the monastery of the Holy Trinity, on the site of the late theatre in Crow Street; the Carmelite or Whitefriars' Monastery, lately restored, in Whitefriar Street; and the nunnery of St Mary de Hogges, on the ground where St Andrew's Church now stands. The precise situations of the nunnery of St Mary des Dames, whence Dame Street has its name, of the abbey of St Olave, somewhere in Castle Street, of the monastery of Witeshan in the west of Dublin, and of the priory of Knights Templars in Catgott, in the southern suburbs, are now unknown. The hospital of St Stephen occupied the site of Mercer's Hospital; the Steyne Hospital stood on Lazar's Hill, now Bank Street; and Allen's Hospital lay between St Kevin Street and the bounds of the archbishop's palace in St Sepulchre's. Though the buildings spread themselves from an early period in all directions, the walls were never extended beyond their original limits. During the civil wars in 1641, indeed, entrenchments were thrown up between the castle and the college, from the river to the vicinity of St Patrick's Cathedral; but being constructed of earth, they did not long survive the necessity to which they owed their origin.

In general it may be observed, that the progress of architectural improvement has taken an eastern direction. Most of the public buildings and new streets lie on that side of the castle, whilst those towards the west are rapidly falling into decay. Hence it is that the boundaries of the civic jurisdiction are in some parts strangely at variance with the arrangement of the buildings. In the north-eastern district the entire parish of St George is beyond the scope of the municipal authorities, whilst in the south-eastern they extend beyond the low-water mark on the South Bull, and to the Blackrock, a village five miles from the castle, including a large tract of arable and pasture land, and the villages of Ringsend, Irishtown, Sandymount, Merrion, Ballsbridge, and Donnybrook. About the year 1770 a road was carried round the city, so as to connect all the outlets; it was called the Circular Road. The boundary thus formed measures somewhat less than nine miles. Latterly the lines of the Royal and Grand Canal on the north and south have afforded a boundary line still more comprehensive; but the entire of the included area is not covered with buildings. A circle, with Essex Bridge as a centre, and with a radius of one mile, will comprehend very nearly all the inhabited part of the city, exclusive of the outlying villages subject to municipal jurisdiction. The area within the limits of the Circular Road covers a space of 1264 acres, of which about 785 are on the southern side, and 478 on the northern side of the Liffey, or Anna Liffey, a name said to be derived from Awen Luiffa, the black river. This river, which, after traversing the city from west to east, through an extent of two miles and a half, reckoned from the King's Bridge to the quay point, near Ringsend, discharges itself into the Bay of Dublin, forming a harbour singularly ill calculated for commercial purposes, in consequence of two sand-banks called the North and South Bulls, between which it flows. Attempts were made to diminish the dangers arising from them, and to deepen the bed of the river, particularly at the entrance, where a bar having but six or seven feet water at low tide prevents the entrance of ships of heavy burden, by carrying out two piers called the North and South Walls, into the sea. The former of these, which is much the shorter, is terminated by a small light-house;

Dublin.

Dublin. the latter extends in the form of a broad road, a mile and a half in length, to the Pigeon House, a collection of buildings originally intended as a landing place for the Holyhead packet boats, but, since the removal of these to the Howth Harbour, converted into a military magazine. It is continued two miles farther as a solid wall, thirty-two feet broad at the bottom, to a light-house at the end of the South Bull. These walls have not had the desired effect of deepening the channel. Within them there is safe anchorage, and vessels not drawing more than fourteen feet water can moor at the quays near Carlisle Bridge. Beyond this point the river is navigable for lighters and row-boats only as far as Sarah Bridge, to the west of the city, where a weir thrown across it puts a stop to further navigation. Both sides of the river are cased by walls of granite, forming spacious quays. These are intersected by nine bridges; Carlisle Bridge, nearest the sea; Wellington Bridge, a single arch of cast-iron, for foot passengers only; Essex Bridge; Richmond Bridge; Whitworth Bridge, formerly Dublin Bridge; Queen's Bridge; Barrack, formerly Bloody Bridge; King's Bridge; and Sarah Bridge. The two last named are each of a single arch, the first of them of iron, the other, a building peculiarly elegant in its proportions, of stone. All except Barrack Bridge are modern and beautiful.

Besides the splendid avenue from east to west formed by the quays, and combining elegance and convenience with health, there are several lines of communication formed of fine streets. The passage through the city from the great northern road is peculiarly striking, particularly at Sackville Street, on account of its great width, and the fine houses of which it is built. The entrance from Kingstown is equally imposing. Both these avenues meet in College Green, an opening surrounded by palaces, and having an equestrian statue of William III. in its centre; their continuance to Dublin Castle, through Dame Street, is also fine. But on deviating from these main lines, the decline of the bustle of business, and of the display of luxury, is immediately visible. Dublin can boast but of five squares; St Stephen's Green, the largest, exhibits some fine mansions, but the houses are irregular, and of very unequal merit in their architectural structure. An equestrian statue of George II. is in its centre. Merrion Square, the next in size, is more uniform and modern. Fitzwilliam Square, the smallest in the city, pleases from its extreme neatness. All these are on the southern side, and nearly contiguous to each other. Rutland Square, also of very limited dimensions, is surrounded on three sides by ranges of splendid private mansions, the fine edifice of the Lying-in-Hospital forming the interior of its fourth side. Mountjoy Square resembles Fitzwilliam Square in its style of architecture, but on a larger scale. These two are in the north-eastern quarter. The streets are well paved, flagged, and lighted, and kept in a very respectable state of cleanliness.

The city, taking the word in its larger acceptation, is divided into nineteen parishes, fourteen in the south and five in the north. The southern are St Andrew's, St Anne's, St Audoen's, St Bridget's, St John's, St Luke's, St Mark's, St Michael's, St Nicholas', within the walls, and St Werburgh's within the civic boundaries; St Catherine's, St James's, and St Peter's, partly within them; and St Luke's wholly without them. St Kevin's parish is included in that of St Peter. Besides these, there are the extraparochial liberties of the deaneries of St Patrick's and Christ Church. The northern parishes are St Mary's, which originally embraced all those on the north side of the river; St Michan's, St Paul's, and Thomas's within the city; St George's in the county; and the late manor, but now the parish, of Grangegorman.

The population of the city is stated by Stanihurst, a native, to have been upwards of 300,000 in 1584. Porter, who wrote in 1680, computed it at the same amount. Though it is nearly certain that each of these estimates is far above the truth, it is impossible to account satisfactorily for the smallness of the numbers in 1645, particularly when compared with the sudden and enormous increase in the beginning of the subsequent century. The accounts, according to calculations at various periods and by different rules, some being merely conjectural, others expressing the number of houses, others that of souls, others again resting on actual enumeration, are given in the following table. In those cases in which the number of houses only is stated, the average of inhabitants is calculated at twelve and a half, that being nearly the amount ascertained in those estimates in which both houses and souls have been taken by actual enumeration.

Date.	Authority.	Houses.	Inhabitants.
1584	Stanihurst	Not stated	300,000
1644	Annals of Dublin	Not stated	8,159
1681	Lynch	Not stated	40,000
1690	Porter	Not stated	300,000
1732	Lynch	13,000	By estimation, 162,500
1744	Lynch	11,923	By estimation, 149,037
1753	Rutty	12,887	By estimation, 161,088
1760	Lynch	13,421	By estimation, 167,758
1788	Bushe	14,327	By estimation, 179,088
1798	Whitelaw	14,854	By enumeration, 182,370
1813	Parliament	14,696	By enumeration, 175,319
1821	Parliament	14,949	By enumeration, 185,881
1831	Parliament		By enumeration, 203,752

In the parliamentary return of 1821 the population of the city has been given in three forms, the first containing the parishes and parts of parishes within the canals, and also within the corporate jurisdiction; the second containing the total area within the canals; the third the same area as the second, together with those parts of parishes beyond the canals. The brief extracts from the returns of 1831 as yet published by parliament give also a threefold view of the population, but whether the limits are the same as those of 1821, cannot be satisfactorily ascertained until the returns shall have been fully before the public. The three statements give the following result:—

	1821.	1831.
1st.....	175,585.....	203,752.
2d.....	224,317.....	232,362.
3d.....	227,335.....	265,316.

Few large cities present a more striking picture of the extremes of splendour and destitution than Dublin. A line drawn from the King's Inns in the north of Dublin, directly south, through Capel Street, the castle, and Aungier Street, will, together with the line of the Liffey, divide the whole area into four districts, materially differing from each other in appearance and character. The south-eastern district, which comprehends three of the great squares, is chiefly inhabited by the nobility, the landed gentry, and the liberal professions. The north-eastern, which includes the two other squares, contains the residences chiefly of the mercantile and official classes. The post-office and custom-house are in this division. These two districts present every appearance of *affluence and luxury*. But on proceeding westward the scene suddenly changes. The south-western district, which includes the liberties of St Sepulchre's and Thomascourt, and was formerly the seat of the silk and woollen manufactures, is in a state bordering on ruin, as is also the north-western

Dublin. district, in which are the barracks, and the great market for cattle and hay.

Dublin is the seat of the local executive, consisting of the lord lieutenant and the privy council. It is also the seat of the supreme courts of judicature, from which an appeal lies only to the House of Lords in Westminster. The lord lieutenant resides, for a few months during spring, in Dublin Castle, but spends most part of the year at an elegant villa in the Phoenix Park. The castle was built in 1205, by Henry de Loundres, archbishop of Dublin. It originally consisted of a single square flanked by towers at each angle, the two southern of which still remain. It contains a suite of apartments for the lord lieutenant, in which are two magnificent rooms, the audience chamber, and St Patrick's hall, where balls are given on that saint's day. The remainder of the buildings are appropriated to the privy council, the apartments of the state officers, and some of the public offices. Other buildings without the square have been successively attached to the castle. The principal of these is the chapel royal, projecting from one of the towers yet standing. It is a beautiful pile of highly finished florid Gothic architecture, of small proportions. Its interior has a fine painted window, and is ornamented with the arms, carved in oak, of all the lord lieutenants of Ireland to the period of its erection. The treasury, the ordnance, the quarter-master's office, and some other minor departments, occupy the remaining space. A guard of state of horse, foot, and artillery, is mounted here daily.

The judicial functions are committed to the lord chancellor, who presides in the court of chancery, the master of the rolls, who holds a subordinate court, and the three law courts, viz. the king's bench, the common pleas, and the exchequer, over each of which four judges are placed. The building where the courts are held, on the King's Inns quay, is a large and highly ornamented pile, consisting of a central part containing a circular hall of large size, in each angle of which one of the four principal courts is held, that of the master of the rolls being in a detached apartment. The wings, which form two small squares, are appropriated to the offices and record repositories belonging to the courts. The prerogative, consistorial, and admiralty courts, are held in the King's Inns buildings, to be described hereafter.

The boards of commissioners which had charge of the principal branches of the revenue all sat in Dublin until very lately. They are now removed to London, and the details here managed by inferior agents. The customs and excise offices were both held in the custom-house, which at first stood on the south side of the river, close to Essex Bridge, but on the erection of Carlisle Bridge they were removed to the magnificent structure erected for them on the north wall, a square building 375 feet by 209, with four fronts, each highly ornamented, and having a beautiful cupola rising from the centre, but recently consumed by fire. At present the officers of customs have little more to do than to collect the duty still levied on coal imported for the use of private families. The business of the stamp-office, which had been transacted in a separate building in William Street, once the private mansion of the Earl of Powerscourt, has been transferred to some of the apartments of the custom-house, vacant since the removal of the boards to London; and the building in William Street has been sold to a mercantile establishment. The post-office, which on its first opening had been held in College Green, is carried on in a fine building in Sackville Street, under the care of a secretary acting under the postmaster-general in London.

A large military force has always been maintained in and near Dublin. The principal barracks are at the western

Dublin. extremity of the city. They consist of four large squares, capable of accommodating two thousand men, both infantry and cavalry. A temporary barrack, capable of containing a regiment of infantry, has been fitted up in some unfinished houses south of the castle. Richmond barrack, for infantry, on the banks of the Grand Canal, beyond Kilmainham, on an elevated and healthy situation, forms a fine and substantial fabric of great extent. Portobello barrack, for cavalry, is on the banks of the same canal, near Harold's Cross. At Island Bridge, near Kilmainham, there is an artillery barrack; and another at the magazine at the Pigeon House.

The municipal government is vested in the lord mayor, two sheriffs, a board of aldermen, and an assembly consisting of ninety-six representatives from the twenty-five guilds of trade, together with an unlimited number of sheriffs' peers. The charter of Henry II. already mentioned was confirmed and enlarged by John, and by numerous others from succeeding monarchs. The latest is that by James II. The chief magistrates were originally styled provost and bailiffs. The former title was changed to that of mayor in 1409, the latter to that of sheriff in 1547. In 1660 Charles II. granted the lord mayor a golden collar, a company of foot, and the right of having a sword of state, a mace, and a cap of dignity. In 1665 the title of lord mayor was conferred on him, and L.500 per annum granted in lieu of the foot company. In 1672 the Earl of Essex, then lord lieutenant, issued new rules for the regulation of the corporation. In 1682 the tholsel was built as its place of assembly; it was taken down in 1807, and the corporation since meets in a plain building in William Street.

The city assembly is formed of two bodies, the aldermen and commons. The latter consists, as already noticed, of representatives chosen every three years by the twenty-five guilds of trades, in numbers proportioned to the estimated importance of each; besides which, every person who has been elected to the office of sheriff has a seat in the commons for life, under the name of sheriffs' peer. In this assembly the sheriffs preside; they are annually chosen from among the representatives of the guilds, by the common council. Each person elected must prove himself by oath worth L.2000. Those who please may decline to serve the office, on paying a sum of L.500. Such persons are said to *fine*, but are not therefore disqualified from sitting as sheriffs' peers.

The aldermen, twenty-five in number, are chosen by the common council out of a list of four names sent down to them by the board of aldermen, which sits in a separate chamber, where the lord mayor presides. They hold office during life. The lord mayor is elected by the aldermen generally, according to seniority; he must be approved and sworn in by the lord lieutenant. This ceremony takes place at Michaelmas. He holds a court for the trial of petty offences and misdemeanours, and settles disputes between workmen, journeymen, and servants, and their employers. During the year subsequent to that of office he presides at the court of conscience, which takes summary and final cognizance of suits of debt under L.2 Irish. Every third year he perambulates the city bounds on horseback, attended by the civic authorities. The tour commences at low-water mark on the South Bull, where he determines the boundary of his jurisdiction by flinging a javelin into the sea. This ceremony, called riding the franchises, was formerly made the occasion of a splendid procession of all the guilds dressed in uniform, and preceded by banners and appropriate emblems. The corporation appoints a recorder, treasurer, town-clerk, secretary, sword-bearer, and other inferior officers. It has also the regulation of the markets. The principal wholesale

Dublin. markets are that of Smithfield for cattle, hay, and straw, and those near the new prison for fruit, potatoes, vegetables, eggs, and fish. There are ten retail meal markets, generally well supplied, but not remarkable for cleanliness, with the exception of the Northumberland market, lately opened in the neighbourhood of Sackville Street by a spirited individual as a private speculation. The custom of slaughtering cattle in private yards is carried on to an offensive extent. A small market for hay, straw, and butter is held beyond the jurisdiction of the corporation in Kevin Street, in the manor of St Sepulchre. The supply of fuel is also in some degree under the control of the corporation. It consists chiefly of coal from England, and some from Scotland; turf is brought in large quantities by both canals. Native coal is also sent to the city from Leitrim and Kilkenny, but not in quantities or at prices to do away with the demand for the imported article. The corporation has also the charge of supplying the city with water, which is brought from the canals into the reservoirs, whence, after having been forced through a filtering machine of excellent construction, it is conveyed by pipes through all parts, so that the inhabitants are copiously supplied with this necessary of life on moderate terms. Fountains are also set up in several places in the poorer parts of the town; but these are under the control of a special corporation.

Four distinct courts, besides the court of conscience, are held within the limits of the lord mayor's jurisdiction; the quarter sessions, at which the recorder, aided by two aldermen at least, presides to try petty offences; the court of oyer and terminer, held by two of the puisne judges of the superior courts for crimes of a graver nature; the recorder's court, which is held in January, April, July, and October, for actions of debt by civil bill process; and the lord mayor's court already mentioned. All are held in the sessions' house, a neat building of hewn stone in Green Street, erected in 1797. The records of the city are preserved in some of the apartments of this building.

For the purposes of police, the city is divided into four districts, nearly corresponding with those already described. In each there is an office, at which three magistrates, one an alderman, the second a common council man, and the third a barrister, all appointed by the crown, sit every day. They have under them an armed force, consisting of fifty-two peace-officers, thirty mounted, and a hundred and seventy dismounted police, and six hundred and fifty watchmen, which last body remains on duty from an hour after sunset till an hour before sunrise. The police has the regulation of the public carriages plying in the city and its neighbourhood. These are chiefly hackney coaches and jaunting cars, which latter are now distributed on convenient stands through most part of Dublin, like the former.

The criminal prison was formerly at Newgate, between Thomas Street and Cutpurse Row, but has been removed to a square building flanked with towers, built in Green Street for the purpose. Originally it was intended for prisoners of every description; but in consequence of arrangements lately made to diminish the numbers by which it was thronged, it is not now often overstocked. It is under the control of the corporation, which appoints all the officers, and has been annually reported by the inspectors-general as among the worst arranged prisons in Ireland. The Richmond General Penitentiary, an extensive pile of building in Grangegorman Lane, was erected to prevent the necessity of transportation, being intended for convicts sentenced to long periods of punishment. It was under the immediate control of the government, by whom the jailor and other officers were appointed. The experiment

has not succeeded. An enquiry into its internal management disclosed several grave abuses, the jailor has been removed, and the building was used for a cholera hospital in 1832. Juvenile offenders are sent, on conviction, to a house of correction in Smithfield. The bridewell on the Circular Road for minor offences is under the city magistrates. It is well regulated. Useful works are carried on so far as to defray part of the expenditure. The treadmill has been introduced into it. The prisoners are also employed in cultivating a large garden for the use of the inmates. The prisons for debtors are four. The Four Courts' Marshalsea receives prisoners both from the city and from all the counties in Ireland. It is in a healthy situation on a rising ground near Thomas Street, and well secured by a lofty wall, but badly ventilated. A plan proposed by an intelligent architect for correcting this defect without the risk of escapes, has not been carried into effect. The Sheriffs' Prison in Green Street is intended for all cases of debt above L.10 contracted within the city. Previously to its erection in 1794, debtors were detained in the residences of the bailiffs, commonly called spunging-houses, a custom which occasioned many gross abuses. For some time also after the opening of this prison, the keeper was partly remunerated by the rents of the apartments. The abolition of prison fees has put an end to this abuse, and the only well-founded cause of complaint at present arises from the limited extent of its accommodations. The City Marshalsea, adjoining the Sheriffs' Prison, receives debtors for sums less than L.10, under decrees of the lord mayor's court and the court of conscience. The prisoners are generally of the poorest classes, and many of them have no resource but casual charity for the support of life; even a lodging in the common hall must be purchased at the rate of a penny a night. The state of the Dublin prisons in general, though considerably improved by the degree of attention lately paid to remedy the defects of their construction and their internal economy, still requires much amelioration, not only with respect to the classification and treatment of the prisoners, but also to the expenditure, which is much greater than what would be found to be necessary under a better arranged system.

Those parts of Dublin not under the civil magistrates are, the manor of Grangegorman, which includes a district in the neighbourhood of Glasnevin and Mountjoy Square, of which the dean of Christ Church is the lord, and appoints a seneschal, who holds his court in a private house. The manor of Thomascourt and Donore, granted to an ancestor of the Earl of Meath, on the dissolution of the monastery to which it had been appendant. Its court was first established in the reign of King John, and still continues open for trial of petty debts and offences. The manor of St Sepulchre, including the parishes of St Kevin and St Nicholas Without, of which the Archbishop of Dublin is lord, with extensive powers that have now nearly become obsolete. It has a court-house and prison attached to it. The ground immediately adjoining the cathedrals of Christ Church and St Patrick are also exempt jurisdictions, subject to their respective deans; but their authority is now little more than nominal.

The seat of the archiepiscopal see is in this city. The palace was till lately in an old building in St Sepulchre's, now converted into a police barrack. The archbishop resides in a house purchased for him in Stephen's Green. He exerts spiritual jurisdiction over the two cathedrals of Christ Church and St Patrick. Of these the former claims the priority by right of antiquity; its foundation is attributed to the Danes in 1038. It stands nearly in the middle of the old city, on the northern declivity of the hill. Earl Strongbow, the invader of Ireland, is in-

Dublin. terred here, and his tomb was long the place at which the tenants of the church were bound to pay their rents. The monument was much injured by the fall of one of the cathedral walls; but was repaired, and is still to be seen in good preservation, with a smaller tomb by its side, having on its top the representation of the superior extremities of a boy cut off at the waist, which circumstance tradition accounts for by informing us that the youth had been cut in two by his father for his cowardice in battle. Several fine monuments are in the aisle; and in the chancel is that of the nineteenth Earl of Kildare, father of the Duke of Leinster. Under the same roof with the cathedral is a small building called St Mary's Chapel. The chapter consists of the dean, precentor, chancellor, treasurer, the three prebendaries of St Michael, St Michan, and St John, and four vicars choral. The cathedral is well endowed; its economy fund, amounting to L.2400 annually, is applied to the payment of the dignitaries and officers, and to the maintenance of the structure, which has lately undergone a thorough repair, both internally and externally. The deanery-house was in Fishamble Street, which being considered a situation unsuitable to a dignitary of the establishment, was sold, and it is now a merchant's warehouse. The dean resides on some of the cathedral lands at Glasnevin, in one of the northern outlets. The cathedral of St Patrick was founded in 1190 by John Comyn, archbishop of Dublin, in a very low situation, and therefore subject to the bad effects of floods, by which it is liable to be inundated. About a hundred years after its erection it was completely burnt, but was soon after raised from its ruins in increased splendour. At the reformation it was dissolved, and the building used for some of the purposes of the courts of justice. King Edward projected its change into a university; but in the succeeding reign of Mary it was restored to its primary destination, which it still retains. The installations of the knights of St Patrick, the first of which took place in 1783, are held here. Its walls have since been ornamented with the helmets, swords, and banners of the knights, those of the present members being suspended over their stalls in the chancel, whence they are removed on their decease into the aisle. This cathedral contains the monuments of several illustrious persons, among which the most celebrated, not so much for the execution of the sculpture, as for the more durable fame of the characters they commemorate, are those of Dean Swift; of Mrs Johnston, immortalized by him under the name of Stella; of Archbishop Marsh, who bequeathed a fine library to the public; of the first Earl of Cork; and of Duke Schomberg, who fell at the Boyne. The northern transept is used as the parochial church of the adjoining parish of St Nicholas Without. The chapter consists of the dean, precentor, chancellor, treasurer, the two archdeacons of Dublin and Glandalough, nineteen prebendaries, four minor canons, and twelve vicars choral. The economy fund amounts to L.2050 per annum. The singing men of these cathedrals perform conjointly at both, and at the chapel of Trinity College, at different hours on Sundays; so that it may be said there is only one choir in Dublin; but that one, from the combination of musical talent, is excellent, although it is a question with many whether the amalgamation, by stifling emulation, does not injure rather than serve the cause of sacred music. The deanery house is in the immediate vicinity of the church. Sir James Ware, who wrote in the reign of Charles I., pronounces this cathedral to be superior to all others in Ireland for magnificence of structure and for extent. Some of the parish churches possess strong claims to admiration. St George's is a fine insulated Grecian fabric, with a highly ornamented steeple and spire. St Andrew's, commonly called the round

church, from its elliptical form, is remarkable for a statue of its patron saint over its entrance; this being the only instance of a statue erected in such a place in Dublin. St Peter's and St Michan's are chiefly noted for their size. The cemetery of the former possesses the bones of the ambitious and arrogant Earl of Clare, who signalized himself in the stormy scenes of 1798. The piety of the inheritor of his title and fortune suffers the remains of him to whom he owes his rank to moulder under the undistinguishing protection of a plain grave-stone. The vaults of St Michan's are remarkable for an antiseptic quality, which preserves the relics deposited there from decay. Among these are the bodies of the two Shears, brothers and barristers, who were among the first victims of the law on the breaking out of the rebellion just alluded to.

The Roman Catholic Archbishop of Dublin also resides in the city. The metropolitan church, in Marlborough Street, is considered as more peculiarly under his charge. This is a building of great dimensions, highly ornamented internally in the Grecian style, but as yet unfinished on the outside, from the want of adequate funds. When complete it will be among the finest specimens of architecture which the city can boast of. The total number of Roman Catholic parish chapels is twelve, all large, but few externally elegant; a circumstance easily accounted for by the fact, that previously to the year 1745 the strict enforcement of the penal laws prohibited the public exercise of their forms of worship. The relaxation of the law was occasioned by the falling in of the floor of an upper apartment, where a Catholic congregation had assembled to celebrate mass secretly, and by which several lives were lost. On hearing of the accident, Lord Chesterfield, then lord lieutenant, nobly declared that he would no longer be accessory to the enforcement of a statute productive of a catastrophe so fatal. The Catholic places of worship have ever since been kept open without molestation; but the apprehensions of their pastors, and the jealousy of the ruling powers, compelled them long after to select places of comparative privacy for their erection. The interior of the chapels in Anne Street and Exchange Street are highly worthy of inspection. Besides the parochial chapels, there are seven belonging to friaries of the Franciscans, the Calced and the Discalced Carmelites, the Capuchins, the Dominicans, the Augustinians, and the Jesuits, and nine belonging to nunneries, viz. two of Discalced Carmelites, two of Poor Clares, two of the Presentation, one of Dominicans, one of the Sisters of Mercy, and one of the Sisters of Charity; the ladies of which last-named order signalized themselves by their zealous and indefatigable attendance on the dying beds of the sufferers in the hospitals during the late awful visitation of the cholera.

Protestant dissenters are by no means numerous in Dublin. There are four congregations of Presbyterians, two of which profess the Trinitarian, and two the Unitarian doctrine; four congregations of Independents, six of Methodists, and of Quakers, Seceders, Baptists, Moravians, Kellyites, and German Lutherans, one each. The few Jews resident in Dublin have no synagogue. The following table will afford a concise view of the comparative numbers of the respective places of abode:

Protestants.	Catholics.	Dissenters.
Cathedrals.....	2	Parish chapels 9
Parish churches.....	19	Chapels of ease 3
Chapels of ease.....	7	Friaries..... 7
Unattached chapels 12	Nunneries..... 9	Methodists.. 6
		Other dissenters one each 6
—	—	—
40	28	20

Dublin.

Each of the parish churches has a cemetery attached to it, in which the parishioners of every religious persuasion were interred, until the restraints imposed on Catholics by the law called the burial casement act, as to performing their burial service over the dead, obliged them to open two large cemeteries, the one at Golden Bridge, the other at Glasnevin, which, though but two years instituted, are both nearly full, to the serious diminution of burial fees to the Protestant functionaries. The profits of these cemeteries, which are considerable, though the fees are much less than what had been previously demanded, are devoted to educating the children of the poor. The vaults of the newly built Roman Catholic places of worship are also appropriated to the reception of the dead. The Jews, the Quakers, the French Calvinists, and the Moravians, have each a cemetery in or near the city.

Dublin has had its full share of the benefits arising from improvements in education. As early as the year 1311 a university was erected in it, under a bull of Clement V. in St Patrick's Church; but it gradually declined, until it became virtually extinct at the close of Henry VII.'s reign. After the Reformation, Sir Henry Sidney and Sir John Perrot exerted themselves to convert that cathedral into a university; but they were overruled by Archbishop Loftus, who protested successfully against what he deemed an encroachment on the rights of the church. In lieu of it, however, he prevailed on the corporation of Dublin to apply the dissolved monastery of All Saints or All Hallows to the same purpose. Hence arose the university of Trinity College, which at first consisted only of a provost, three fellows, and three scholars; but now of a provost, seven senior fellows, who together form a board which has the regulation of all the concerns; eighteen junior fellows, and seventy scholars, besides several professors in various branches of science. The number of under graduates amounts to more than 1200. The buildings form three large squares, and are used partly as dwelling apartments, partly for the purposes of education. The library, consisting of more than 100,000 volumes, is deposited in a noble gallery 210 feet long, adorned with busts of distinguished literary and scientific characters from Homer to the present day. It is rich in modern English publications, in consequence of having the right to a copy of every book published under the copyright act, and also in theology. It likewise possesses some valuable manuscripts. Its greatest defect is a want of modern continental publications. The chapel and examination hall are also fine buildings; the latter contains a very fine monument of Dr Baldwin, one of the chief benefactors to the college, and some portraits of other remarkable personages. The dining-hall, a plain building, has also some similar portraits. The museum is not well stocked; but the botanic garden in the suburbs is maintained in a manner highly creditable to the college. The school of anatomy is of first-rate excellence. The regular course of studies for a bachelor's degree continues for four years, during each of which the student is subjected to four examinations; and at the close of this period gold medals are awarded to the two best answerers in science and the classics. The college observatory is at Dunsink, about five miles north-west of Dublin. The revenues arise from lands to a large extent, and from the fees of pupils. The college has also the disposal of a number of valuable benefices, which, when vacant, are offered to each of the fellows successively, commencing with the senior. The acceptor consequently vacates his fellowship, which is filled up by election, after a severe public examination by the provost and senior fellows. During the short reign of James II. a college for Roman Catholics was opened in Back Lane, but was extinguished on his abdication.

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The Inns of Court were intended for the instruction of law students. Collet's Inn, the first appropriated to this purpose in the reign of Edward I., having been erected without the city walls, was destroyed, together with the king's exchequer, by an incursion of the Irish from the Wicklow Mountains. The inns were revived during the reign of Edward III. in a building near the castle, given by Sir Robert Preston, chancellor of the exchequer, and thence called Preston's Inns, where the institution was maintained for upwards of two centuries. But the society being dispossessed in consequence of a flaw in the title, the inns were removed to the dissolved monastery of St Saviour's, where the four courts now stand, and there took the name of King's Inns. These buildings having been suffered to fall to ruin, a new site was chosen in the northern extremity of Dublin, where they are now held. The principal apartments are the dining-hall and the library, which latter forms a detached building. Law students are obliged to attend terms here for two years previously to being allowed to practise as barristers; but as no arrangements have been made for literary instruction beyond the use of the library, punctuality of attendance is ascertained solely by their presence in the dining-hall, and therefore they are facetiously said "to eat their way to the bar."

The school of medicine is partly under the control of the board of Trinity College, which nominates and maintains professors of anatomy, chemistry, and botany, and partly under that of the college of physicians, which nominates the professors of the practice of medicine, of the institutes of medicine, and of materia medica, who are paid by grants of public money; but the emoluments of all depend likewise on the fees of pupils. The college of physicians was first incorporated by Charles II., and renewed by William and Mary. It enjoys some important privileges; among others, the right of inspecting the shops and stores of apothecaries, druggists, and chemists, and of destroying drugs of bad quality. The college consists of fourteen fellows, on whom the management devolves; of honorary fellows, who are excluded from any interference with the financial arrangements; and of licentiates, who, though not entitled to take any part in the management of the collegiate concerns, are summoned on occasions of importance. Every physician practising in Dublin deems it necessary to take out a license, which is granted on examination. The college meets at an infirmary in the south of Dublin, founded by Sir Patrick Dun, who bequeathed a large estate to it, and to other uses connected with the advancement of medical knowledge.

Surgery was long considered in Ireland, as well as in England, as a trade, the practitioners being included in the worshipful corporation of barber-surgeons. Nor was it till 1784 that a charter, founding a college of surgery, put the practice of that inestimable art on a basis enabling it to advance in a manner suited to the wants and character of a civilized nation. Still, indeed, so much of the antiquated prejudice prevails as to require, though not of necessity, the servitude of an apprenticeship for five years. The college, which was at first held in an obscure building near Mercer's Hospital, has been removed to an elegant range of buildings in St Stephen's Green, where lectures on all the most important branches are delivered, a museum, dissecting-room, and library kept up, and examinations held for the admission of practitioners. The large amount of fees on a diploma has, however, deterred many from taking advantage of this arrangement, and obliged them to have recourse to London, where the low rates of fees more than compensate for the trouble and expense of the journey thither.

The apothecaries also have some share in the comple-

Dublin. tion of a medical education, by lectureships and examinations on chemistry and pharmacy at their hall in Mary Street. Their establishment consists of a governor, deputy-governor, treasurer, secretary, and thirteen directors.

There is in Dublin no classical school on a public foundation similar to the great grammar schools in London and Westminster; but the institutions for the literary instruction of the poor are numerous. According to the returns made in 1824-26, there were then nineteen parochial schools maintained partly by the incumbent and partly by subscriptions and charity sermons, eleven assisted by issues of public money through the Kildare Place Society, two assisted in a similar manner by the Association for discountenancing Vice, one by Erasmus Smith's bequest, two by the Charter School Society, and fifty-six by private contributions from charitable societies and individuals. The number of schools wholly maintained by the pupils' fees is 323, making the total number 412.

Hospitals or asylums for those reduced by age or other causes are also numerous, and liberally supported. The chief is the House of Industry, in North Brunswick Street, originally established in 1773, in the vain hope of abolishing mendicity. After an experience of forty-five years, it was found to be totally inadequate to attain its object, notwithstanding the great outlay in buildings, and the heavy annual charges for its maintenance. The buildings, therefore, instead of being, as before, open to mendicants of every description, now receive only the aged and disabled poor. The main edifice consists of a large square 265 feet by 230, attached to which are other ranges for workhouses, stores, and the like.

Lunatics are maintained in St Patrick's Hospital, founded by the celebrated Dean Swift, and conducted by governors appointed under its charter. The unhappy inmates have every indulgence compatible with their situation. The General Lunatic Asylum, erected near the House of Industry, and placed under the care of officers appointed by government, originally received patients from all parts of the country; but, under a late act of parliament, it has been limited to a district consisting of the counties of Dublin, Louth, Meath, and Wicklow, each of these contributing towards its expenses in proportion to the number of patients sent in. The number in 1831 was 239, of which 101 were males and 138 females. A lunatic department is also attached to the House of Industry, to which incurable and epileptic patients are periodically transferred from that just described. There were, in 1831, 470 patients in it, namely, 179 males and 291 females, of whom 105 males were employed, chiefly in gardening, and 152 females in occupations suitable to their sex, and conducive to the economy of the institution. They are well and economically supported. Cases requiring severe corporeal restraints are uncommon; and the whole institution, notwithstanding the limited extent of accommodation, is conducted in a manner highly creditable. Besides these public establishments for the recovery and safe custody of lunatics, five others are maintained by private resources; one near Donnybrook, called the Retreat, by the Society of Friends, and four others by medical practitioners for their own emolument.

The principal institution for the blind is Simpson's Hospital, founded by a merchant of Dublin, who had laboured under severe affections of the eyes, and under gout. The income is upwards of L.2500 per annum, by which fifty patients, either blind or gouty, are comfortably maintained, in a large plain edifice in the northern side of Dublin. The apartments can accommodate a hundred inmates. The Richmond National Institution in Sackville Street was founded in order to instruct the blind in some of the more useful handicraft occupations. The principal

branches taught are weaving, netting, and basket-making. The number of inmates is about thirty-two, besides some externs, who, after having been taught, are allowed to work there, and to dispose of the produce of their industry for their own benefit. These two hospitals are for males only. The Molyneux Asylum, opened in Peter Street, in a large building which had been an amphitheatre for equestrian exhibitions, is confined to blind females, of whom those above the age of fifty have in it a permanent asylum, while those under that age are admitted to a temporary residence, until they can procure a permanent livelihood elsewhere. There are about twenty on the establishment; the building could accommodate fifty. The Retreat at Drumcondra was opened, and is supported, by some private individuals, to afford a temporary asylum to aged and indigent persons of respectability suffering under some sudden emergency. The Old Men's Asylum, near Mountjoy Square, accommodates twenty-four inmates, who must be at least sixty years old on admission, and Protestants; servants and retailers of spirituous liquors are specially excluded. The Vintners' Asylum, in Charlemont Street, affords a place of shelter for indigent persons of the last-named class. The Goldsmiths' Jubilee, founded in the jubilee year by members of that corporation, affords a similar place of shelter for reduced and superannuated artizans of the trade. An institution for the maintenance and education of children born deaf and dumb is maintained at Claremount, near Glasnevin. The plan of the Royal Hospital, for decayed and maimed soldiers, was first suggested by the Earl of Essex, when lord lieutenant, and was carried into effect through the repeated applications of the Duke of Ormond to Charles II. The site chosen for it had been the ancient priory of Kilmainham, founded by Strongbow for Knights Templars. Upon the extinction of that order, and the confiscation of its property, which was effected by a simultaneous and secret movement of all the crowned heads in Europe, this part of their possessions was transferred to the Knights of St John of Jerusalem, and it became an hospital for guests and strangers only, to the exclusion of the sick and maimed. On the dissolution of monasteries, it devolved to the crown, and so continued till applied to its present use by Charles II. The building, which is according to a plan of Sir Christopher Wren, is a square 306 feet by 288, three sides of which are dwelling-rooms, connected by covered corridors. The fourth contains the chapel, a venerable building, of limited size; the dining hall, in which the banners taken from the Spaniards at Gibraltar are suspended; and the apartments of the master, who is always the commander of the forces for the time being. Connected with the main building are several subordinate offices, a garden, and avenue bordered by rows of stately trees. The entrance from Dublin is through an embattled gateway on the south side of Barrack Bridge. The resident veterans wear the military costume of Charles II. Besides these, there is a great number of out-pensioners. The annual expenditure of the house is about L.20,000, that of the externs L.50,000. Of hospitals for reduced and aged women there are, 1. widows' alms houses; thirteen of these are of Protestant foundation, the principal one being for clergymen's widows, who are comfortably lodged and maintained in an asylum in Mercer Street; three are Roman Catholic, one Presbyterian, one Independent, one Moravian, and one Methodist: 2. an asylum for superannuated female servants, on Summer Hill: 3. two houses of refuge for young women of good character when out of service, one for Protestants, in Baggot Street, the other for Catholics, in Stanhope Street: 4. six female penitentiaries, four under the direction of Protestants, viz. the Magdalen Asylum, in Leeson Street, founded by Lady Arabella

Dublin.

Dublin. Denny; the Female Penitentiary, on the North Circular Road; another under the same name on the South Circular Road, near Baggot Street, and the Lock Penitentiary, for the special reception of penitents from the Lock Hospital; two under the management of Catholics, viz. the General Asylum, in Townshend Street, and the asylum in Bow Street. This latter has something romantic connected with its origin. The founder, a merchant of the name of Dillon, had been exposed, when an infant, at the door of a bricklayer, who preserved him, and taught him his trade. On arriving at years of maturity, he was accosted, while returning homewards, by an unfortunate street-walker. Instead of yielding to her allurements, he persuaded her to relinquish her abandoned line of life, and engaged to provide her with the means of subsistence till a permanent asylum could be procured. While thus occupied he was recognised by his parents, and succeeded to a considerable estate, part of which he devoted to the endowment of this asylum. A penitentiary has also been opened on the South Circular Road, for females discharged from prison, until means of honest employment present themselves.

Among the asylums for destitute children, the Foundling Hospital was by much the most extensive. It was opened in 1730 for destitute children of every age, but afterwards limited to the reception of those under a year old, who are sent to nurse in the country until old enough to be instructed. When arrived at a suitable age, they are apprenticed. The institution was maintained partly by voluntary contributions, partly by a local tax on Dublin, but chiefly by large parliamentary grants, which have been gradually diminished for several years past, and restraints put on the admission of children. The average number of children admitted for twenty years up to 1825 was 2000. Dr Bell's system of education is adopted in the schools. The buildings, with large gardens attached to them, are situated in a healthy and elevated situation in the west of Dublin. The Blue Coat Hospital was originally intended as a place of refuge for all the poor in the city. This object being soon found impracticable, it was reduced to an asylum for aged citizens and their orphan sons, and ultimately confined to this last-named class. The buildings in Oxmantown originally covered a considerable space; and previously to the building of the parliament house in College Green the parliament held its sittings there. The present edifice is built nearly on the site of the former. It consists of an elegant centre, with detached wings, one used as a chapel. Of 120 boys it receives, fifty-eight are named by the corporation, fifty by the governors of Erasmus Smith's schools, ten by the Bishop of Meath as trustee to a bequest, and two by the incumbent of St Werburghs on a similar title. They are educated in the tenets of the Protestant church, and apprenticed to Protestant masters. The Hibernian Nursery in the Park supports and educates the children of soldiers. A preference is given to those whose fathers have been killed, or died on foreign stations. The buildings, which are spacious, have gardens and exercising ground attached to them; and the boys, in addition to the usual routine of scholastic instruction, are trained to the rudiments of military tactics. On the southern quay, near Ringsend, is the Hibernian Marine School, instituted for sailors' children. It consists of a centre building and two wings, the latter containing the school and chapel. The age of admission is six years, and the course of instruction nautical. At a proper age the pupils are placed in the royal navy, or apprenticed to merchants, who take them without fee. The number of boys was 180; but it has been contracted in consequence of the reduction of the parliamentary grant. The Bedford Asylum, for industrious children, is one of the existing branches of the

House of Industry. It forms three sides of a square, Dublin. and contains apartments for 390 children of both sexes, in which they are taught various kinds of useful works. The teachers are paid by a portion of the profits of the children's labour in lieu of salary. The principal establishment for female orphans is that on the North Circular Road, originating with two benevolent ladies, who formed an institution for maintaining female orphans under ten years old. The funds were soon considerably augmented by the exertions of the celebrated Dean Kirwan, whose appeals from the pulpit for several years brought in a large additional income. It is now supported by subscriptions, charity sermons, and a grant of public money. It can accommodate 160 children, who are educated for servants, and apprenticed at a proper age. The freemasons of Ireland formed an institution in 1797 for the support of female orphans of the craft. It supports about twenty children. In Pleasants' Asylum twenty female Protestant children are maintained and educated; and, when of age, receive a handsome portion on marrying conformably with the rules laid down in the founder's will. Most of the places of religious worship have attached to them schools, in which a certain number of the destitute children of the parishioners, chiefly orphans, are maintained by the contributions of the benevolent part of the congregation.

The progress of disease is combated, and the sufferings from accidental injuries assuaged, by means of numerous infirmaries and dispensaries. Of the former, the most extensive of those which take in cases of all kinds, surgical and medical, is Stevens' Hospital. It was founded by the bequest of a physician whose name it bears, and erected by his sister, who having been left a life interest in the property previously to its being applied to its final purpose, immediately devoted the greater part of it to fulfil her brother's intentions, reserving to herself only L.120 per annum, and apartments in the hospital. In addition to the original estate, and to other contributions and bequests, it receives a grant of public money; through all which means, its income, amounting to L.2200 per annum, supports about 200 beds. The Meath Hospital, originally built on the Coombe, for the benefit of the liberties of Dublin, and afterwards converted into a county hospital by act of parliament, has been transferred from its former confined and low situation to another in the outlets, where a large building was erected for it, chiefly through the munificence of Mr Thomas Pleasants, who contributed L.6000 towards its building and maintenance. Its annual income exceeds L.1000. The medical officers at first received salaries of L.100 each, which they have resigned for the benefit of the institution. The hospital on the Coombe, after having been closed for some time, has been restored to its former purpose by voluntary subscriptions. The Charitable Infirmary, in Jarvis Street, the oldest in Dublin, and opened at first in Cook Street by the contributions and exertions of a few gentlemen of the medical profession, was transferred to its present situation in 1792. It is capable of accommodating fifty patients, but the state of its funds seldom admits of more than thirty. The Royal Military Infirmary in the Phoenix Park, near its entrance, is a general infirmary for the army. The edifice, though plain, is much admired for the elegance of its proportions. The interior is provided with everything requisite for such an institution. The total annual expense of each patient is estimated at L.33, which is defrayed by a public grant, and by stoppages of the soldiers' pay while in hospital. Sir Patrick Dun's Hospital is appropriated exclusively to medical cases, for the instruction of the pupils attending the professors of the College of Physicians. The Richmond Hospital, a part of the House of Industry, and Mercer's Hospital, founded by a benevolent

Dublin. Lady of that name in Stephen Street, on the site of the decayed hospital of St Stephen, are set apart for surgical cases and accidents. There are three fever hospitals. The House of Recovery in Cork Street, the first and largest, supported by subscriptions and public money, has contributed to check considerably the progress of low fever prevalent among the ill-fed artizans and paupers in that district. Its beneficial effects led to the opening of a second in the north of Dublin, on a smaller scale, called the Whitworth Hospital; the third, the Hardwick Hospital, is another of the appendages of the House of Industry. The Lock Hospital was opened in Townshend Street in 1792, for the reception of venereal patients of both sexes; but in 1820 male patients were excluded, and it has been ever since confined to females. The number of beds, originally 300, is now reduced to half that number. The building, of plain granite, consists of a centre containing apartments for the officers, and two wings in which are the patients' wards. It is wholly under the control of a board appointed by the lord lieutenant.

The formation of dispensaries is encouraged by a special act of parliament authorizing grand juries to present in aid of them a sum equal to that subscribed by individuals. Most of the infirmaries in Dublin have dispensaries attached to them, besides which there are several unattached. St Mary's and St Thomas's was the first established; the next in importance is the Dublin General Dispensary. The Meath Dispensary has connected with it a department for supplying food, from a conviction that much of the disease incident to the poor arises from or is augmented by unwholesome or deficient nutriment. A vaccine establishment is carried on extensively in Sackville Street; and a second, connected with a dispensary for the infant poor, in Clarendon Street; their efficacy is more highly appreciated every year. There are also several minor district or parochial dispensaries in various situations, for particular complaints.

The most remarkable charitable institution among those which do not undertake to supply lodging as well as maintenance, is the Mendicity Association, formed in 1818, and since supported solely by voluntary contributions. It originated in a well-founded conviction of the inefficacy of the attempt to prevent the practice of street-begging in Dublin, through the medium of the House of Industry, from which it differs in two important points; the one, in declining to provide the poor with lodging, but merely with food, and in obliging them to procure the means of lodging and clothing themselves by their own labour, for the exertion of which the society procures the means; the other, its total dependence on voluntary contributions, to the utter rejection of grants of public money. The manager's committee publishes annual reports, which show that, though it has been more than once on the eve of dissolution through want of pecuniary resources, it still continues to exist in vigour sufficient to diminish considerably, though not wholly to suppress, the custom of street-begging. The Sick and Indigent Room Keepers' Society originated in an effort made in 1790, by a few householders in the neighbourhood of Corn-market, to provide for the most urgent necessities of the poor in their neighbourhood, by affording a temporary weekly stipend in money for their lodging and maintenance. It has since extended itself throughout the whole city, and is managed by four committees for its four divisions, who hold a joint meeting every month to receive reports and issue grants. The Strangers' Friend Society somewhat resembles that just described, but is more particularly directed to the relief of strangers reduced to want during their temporary sojourn in the city. It was set on foot, and is chiefly supported, by the Methodists. The Charitable Association has

for its object the relief of all paupers not street beggars, and the procuring of work for the industrious poor. Another society, confined to the latter object alone, and established by the Society of Friends, meets at the House of Refuge in Dorset Street. The Dorset Institution in Abbey provides suitable work for industrious females; children are also taught in it to plait straw; and a wareroom is opened, in which wearing apparel, made up by the poor employed, is sold at reduced prices. The Debtors' Friend Society is formed for the release of debtors confined for sums under L.5, and not contracted for spirituous liquors, or for other improper purposes. The Musical Fund, for the special relief of distressed musicians, was formed from the profits of concerts, and is supported by the annual subscriptions of the members, who have thereby a right to its benefits under certain restrictions. The Literary Teachers' Society has the same object with respect to members of their own profession, by whom also it is chiefly supported. There are two associations for lending small sums to poor tradesmen, payable by instalments without interest; the one, the Meath Charitable Society, and the other, the Charitable Loan. They meet monthly in the vestry rooms of St Catherine's and St Anne's parishes. The system of Savings' Banks was introduced into the city by an association, which had influence enough to procure an act of parliament, establishing them on provisions adapted to the country. The principal bank is in School Street, which now has several branch banks in various parts of the city. Another was afterwards opened in St Peter's parish; but after continuing some time, its affairs fell into confusion, from which it is now endeavouring, it is hoped successfully, to extricate them.

Most of the religious societies spring from kindred sources in England. The chief among them is the Hibernian Bible Society, founded in 1807, and which has now a fine establishment in Sackville Street. Several minor societies for the distribution of the Bible, and differing from one another chiefly as to the channel into which their labours should be directed, have arisen from it, some detached, others auxiliaries or branches of the parent association. The Irish Society was formed for promoting the religious instruction of the Irish through the medium of their own language, by publishing Bibles, Testaments, tracts, and rudimental books in that tongue, and by sending itinerant teachers through the country for their instruction. The names of the Church Missionary, the Tartarian Missionary, and the Methodist Missionary Societies, announce the origin and objects of each. The Jews' Society undertakes the conversion of that nation to the Christian faith. The Religious Tract Society has an extensive store and sale-room in Sackville Street. The Continental Society professes generally to promote religious knowledge and sentiments throughout Europe.

Scientific and literary societies are few. The Royal Dublin Society is foremost in seniority and importance. It owes its origin to some literary characters, who in 1731 formed an association for scientific purposes. In 1749 it was incorporated by charter, and received an annual parliamentary grant of L.500, which was gradually augmented until it amounted to L.10,000, but latterly it has been reduced to L.7000. It embraces a variety of objects. The encouragement of agriculture and rural economy is attempted by shows of cattle, and by botanical lectures, for which the society maintains a fine garden near Glasnevin, containing upwards of twenty acres. The study of mineralogy is promoted by a professorship, and a museum classed according to the Wernerian system. It contains the Leskean collection, which is peculiarly rich in shells, butterflies, beetles, and reptiles. Lectures are also delivered by professors of chemistry and natural philosophy.

Dublin. The professorships of mining and the veterinary art have been discontinued. A drawing school is established, in which pupils of promising talents are instructed gratuitously in landscape, figure drawing, architecture, and modelling, and premiums are periodically awarded. The society is also provided with a good library, containing upwards of 12,000 volumes. It is particularly rich in works on botany, and in those relating to Ireland. It has likewise a gallery of statuary, in which are casts from the Elgin marbles. The museum and gallery are open to the public on particular days. The members, who are admitted by ballot, on payment of an admission fee of L.30, which covers all subsequent expenses, have the exclusive advantage of the library, and of a reading-room well supplied with newspapers and periodicals. By a late bye-law, annual members are admissible to most of the advantages of the society on payment of a subscription of three guineas. The society held its meetings in Shaw's Court until 1767, when it removed to Grafton Street, and thence in 1796 to a building erected for it in Hawkins Street. It 1815 it purchased the splendid museum and grounds of the Duke of Leinster in Kildare Street, where it still continues. The Farming Society was formed in 1800, and incorporated in 1815. It was maintained by grants of public money; but as the results were ultimately found not to be commensurate with the expenditure, the grants have been withdrawn, and the society has sunk into non-existence. The Kirwanian Society, which takes its name from the celebrated chemist and mineralogist, was formed in 1812 for the advancement of chemistry, mineralogy, and natural history. It is supported wholly by individual subscription. The Zoological Society, formed in 1830, on the model of those in Dublin, has a garden on land granted to it by the lord lieutenant in the Phoenix Park, in which it has already collected an assemblage of living animals, which makes it an object of general attraction to the citizens of Dublin. It is supported by subscriptions, and by the money paid by the public for admission. The Royal Irish Academy was instituted by patent in 1786, to promote the study of polite literature, science, and antiquities. Its formation was chiefly owing to the exertions of its president, the first Earl of Charlemont. It holds its meetings in Grafton Street, where it has a small library containing some valuable manuscripts, and occasionally publishes a volume of transactions. This society receives an annual parliamentary grant of L.300. Several fruitless attempts have been made to excite a taste for Irish antiquities and literature, by societies under the names of the Gaelic, the Hiberno-Celtic, and the Archæologian. Each has successively failed, but not until the two first named had sent forth some publications connected with the objects of their formation. The Dublin Institution, formed in 1811, in imitation of the London Institution for literary and scientific purposes, collected a literary and philosophical apparatus for the use of its members by means of a capital of L.1500 raised in L.50 shares. The society has been virtually dissolved this year (1833), by the sale of its books, and the announcement of its intention of disposing of its mansion in Sackville Street, on which a considerable sum had been expended for a lecture room and laboratory.

Several attempts have been made to excite a taste for the fine arts in Dublin. In 1764 an association of artists erected a neat building in William Street for their meetings, and for the exhibition of their works; but the profits of the scheme did not cover their expenses, and the building was consequently offered for sale, and purchased by the corporation of Dublin as an assembly-house. Exhibitions of pictures by native artists were afterwards opened in Hawkins Street, under the patronage of the Dublin Society. On their discontinuance there, in con-

sequence of the society's removal to Leinster House, which afforded no suitable room for it, the artists attempted their revival in the Royal Arcade in 1821, but without success. These failures are attributable not merely to the indifference of the public to the subject, but to dissensions among the artists themselves. The want of a permanent place of exhibition has at length been supplied by the liberality of Mr Francis Johnston, an architect to whom Dublin is indebted for several of its modern buildings, particularly the new Castle Chapel. He built an elegant and appropriate structure, at an expense of L.10,000, which, when finished, he presented to the Society of Artists. Their exhibitions have been held in it since its opening in 1825. The society was incorporated in 1823. The progress of the arts has been still further promoted by an association of noblemen and gentlemen, who, under the name of the Royal Irish Association, have erected a building near College Green, in which an annual exhibition of pictures of the old masters, sent in for the occasion by their owners, is held, and premiums are occasionally offered to excite emulation among the young artists. This association also defrayed the expenses of procuring the patent for the Irish artists' charter, amounting to L.350.

The principal library in Dublin for the number and value of its books is that of Trinity College. It is open of right only to such graduates of that university as take a strict oath relative to their conduct while in it, and to their treatment of its contents. Admission by special favour is attainable, but with some difficulty. The King's Inns Library is next in value. The right of reading in it is confined to the members of the King's Inns Society; that is, to barristers, attorneys, and law students. Each of these libraries is well supplied with modern English publications, in consequence of the right conferred on them by act of parliament, of receiving a copy of every new publication. Marsh's Library, attached to St Patrick's Cathedral by the munificent bequest of an archbishop of Dublin of that name, contains a good collection of old books, and is open to the public on liberal terms; but, from the very small portion of its funds appropriated to the purchase of books, it is very deficient in modern publications. It possesses some valuable manuscripts. Stevens' Hospital, the Royal Hospital, Sir Patrick Dun's Hospital, and the College of Surgeons, have each a small library attached to it, chiefly of medical books, for the use of the practitioners. The want of a public library easily accessible, and provided with the works most in request, was attempted to be supplied by a society, which, having been formed in 1791, has collected a large number of books in a handsome and well-arranged building, raised for their reception in Dolier Street. Attached to it is a fine reading-room, well supplied with newspapers. But as the fund, arising solely from annual subscriptions, is not sufficient to stock the library with new publications, and to furnish a sufficient assortment of newspapers, the former of these demands has been made subordinate to the latter, and the library consequently impoverished. The other public reading-rooms are that in the Commercial Buildings, to which members are admitted by ballot and the payment of an annual subscription; and the Northumberland Reading-room, opened by the proprietor of an hotel near the Custom House as a pecuniary speculation.

Dublin owes its commercial rank chiefly to its political position as the metropolis of Ireland, and to its being the main pivot of communication with England. The natural impediments to the entrance of large vessels into the river, combined with the dangerous navigation of the bay, present serious checks to the ardour of mercantile speculation. The want of a communication with the interior by water is but imperfectly supplied by the two lines of

Dublin. inland navigation proceeding from it. A particular account of these must be postponed to its appropriate place in the general account of Ireland. As far as Dublin is concerned, they are mainly serviceable in conveying to it bulky articles, such as stone, bricks, potatoes, grain, and turf. The increase of commercial transactions occasioned by a long continuance of domestic tranquillity after the revolution of 1688, excited a desire among the merchants to have a suitable place for transacting their public business with one another, and consequently the foundations of the Royal Exchange were in 1769 laid on Cork Hill, and the building was opened in ten years after, at an expense of L.40,000, procured by subscriptions, lotteries, and grants of public money. It is one of the most admired structures in Dublin. Its principal front consists of a Corinthian portico of six pillars. The interior is chiefly occupied by a magnificent circular hall lighted from above, with which several smaller apartments are connected. The progress of civic improvements already noticed gradually threw this fine building out of the more convenient channels of business. A more central position for mercantile transactions presented itself in College Green. Thither therefore the sagacity of speculation was directed, and a new building has been raised, principally by L.50 shares, with more numerous and suitable accommodations, under the name of the Commercial Buildings. The value of the Royal Exchange has consequently diminished. It is now little used except for public meetings, for which the reverberation of the voice from its lofty dome, and the intercolumniations of the great hall, render it unfit. It is also a depository for the statues of celebrated characters, and has in it those of George III., Henry Grattan, and Doctor Lucas. The Commercial Buildings form a small square of simple architecture fronting College Green. They contain a large saloon occupied as a news-room, and a number of offices for merchants and brokers, together with an hotel and coffee-house. In order still further to promote the commercial interests of Dublin, an association was formed about thirty years ago, under the name of the Chamber of Commerce; but it soon died away. The idea was revived in 1820, when a number of merchants formed themselves into a society under the same name, which still exists. Its objects are the protection and promotion of the manufacturing and commercial interests of Dublin, and of the country in general. The business is transacted by a council, which is instructed to communicate with the officers of government on the subjects of the association. Their office is held in the Commercial Buildings. The Ouzel Galley is another voluntary association of merchants, for determining commercial differences by arbitration. It takes its name from that of a vessel, which was the occasion of a complicated and protracted suit, that was ultimately adjusted in an amicable manner by the interference of some of the most respectable merchants in Dublin. The effect of steam-navigation on the cross-channel trade has produced a great alteration in the state of commerce in Dublin. Most of the business formerly transacted through the merchants of this city is now carried on by letter with the English broker, and not unfrequently by a personal visit to the trading and manufacturing towns in England, to which access is obtained with extraordinary expedition and cheapness, by the steamers, and by the peculiar facilities for travelling which that country affords.

The Bank of Ireland was formed in 1783, in order to give security to commerce. It was opened at first in some old houses in Mary's Abbey, with a capital of L.600,000, which was afterwards increased to L.3,000,000. In the year 1802 the parliament-house was purchased by the directors, and adapted to its present destination. This edi-

fice was erected in 1729; and notwithstanding the changes made in it since it was diverted from its original purpose, the exterior has been but little altered. It consists of three fronts. The principal, towards College Green, a colonnade of the Ionic order, formed of a façade and two projecting wings, is much admired for the noble simplicity of its elevation. The western front, a portico of four Ionic columns, was connected with the other by a colonnade of the same order, forming the quadrant of a circle. The eastern front, which was the entrance of the House of Lords, was, by their special order, a colonnade of the Corinthian order, which the architect found great difficulty in uniting with the other parts. The apartment for the Lords, a fine room, was hung with tapestry. That of the Commons having been burned in 1792, whether by accident or design has never been fully ascertained, was reconstructed after a more elegant design, in the form of a circle surrounded by pillars, between which was a gallery for hearers. This fine hall was taken down by the bank directors, and converted into a square room, now the cash-office. The bank possesses a very curious and complicated system of machinery, worked by steam, for printing the notes, whereby the number struck off can be ascertained at any moment without the chance of error. It has also an armory, containing small arms for all the clerks and servants, who were formed into a corps in 1798 and 1803. The building is still further secured from assault by embrasures and loopholes concealed in the walls. Tanks of great magnitude, and powerful forcing pumps, have been provided for guarding against casualties by fire. The private banking houses are those of Latouche and Company, which transacts the Dublin part of the business of the provincial bank, the Hibernian, Shaw's, and Ball's.

Dublin. The silk, woollen, and cotton manufactures, have been carried on in Dublin. The first was introduced by some French refugees on the revolution of the edict of Nantz. It employed a number of hands, until the alteration in the duties in 1815 gave it a blow from which it has never recovered. It is now nearly extinct. The article most in demand was a mixed fabric of silk and worsted, called tabinet, or Irish poplin. The woollen manufacture gave employment for many years to the greater part of the population of the liberties. Their hall on the Coombe is embellished with a statue of George II. The process of tentering the cloth was long performed in the open air; but as the broken weather to which the country is subject frequently interrupted this part of the manufacture, or compelled the workmen to have recourse to public houses to dry their webs, Mr Thomas Pleasants, whose name has been already more than once mentioned as a most munificent contributor to the benevolent institutions, erected a tenter-house in Cork Street, at an expense of L.13,000. This branch is also rapidly declining. The cotton trade has always been carried on to some extent in Dublin since its introduction into Ireland, but there is no public building especially connected with it. The board of trustees for the linen manufacture at first met in a room on Cork Hill, afterwards in an apartment in the castle, and ultimately in buildings erected for the promotion of the manufacture in the north of the city. These buildings occupy nearly three acres, and consist of six courts, surrounded by stores communicating by piazzas and galleries. Part is used as a yarn hall. The trustees, who were nominated from among the leading personages in each of the four professions, were entrusted with the distribution of a large sum for premiums and other expenses. The board has been dissolved; but the buildings are still kept up as warerooms and stores, under the care of a chamberlain.

Dublin.

The Corn-Exchange was built to obviate the inconveniences felt from the want of a well-situated mart. A charter was obtained in 1817, and a fund raised by shares, with which a large hall has been erected on Burgh Quay, in which grain is sold by sample. Attached to it are buildings intended for an hotel, and hall for public meetings, which latter was used as such by the Catholic Association, and since by the National Political Union.

There are few cities in which the pleasures of domestic society are more indulged in than in Dublin. A spirit of sociability pervades all ranks. One consequence of this peculiar feature is a disregard of public amusements. In Queen Elizabeth's time plays were performed in the ball-room of the castle by the nobility and gentry. In 1635 Lord Strafford erected a theatre in Werburgh Street, for which Shirley wrote. It was closed in 1641. After the restoration a new theatre was opened in Orange Street, now Smock Alley, under the former patent. In 1733 there were three theatres; one in Bainsford Street, in the liberty of Thomascourt; another in George's Lane; and the third in Smock Alley. In 1745 Mr Sheridan had a theatre in Aungier Street, which was destroyed in a riot in 1754. Smock Alley still continued open; and in 1758 another was opened in Crow Street, after which both continued, until, after a violent struggle for twenty-five years, the former was given up. On the expiration of the patent, about 1820, the new patentee, not being able to procure the building in Crow Street on what he deemed reasonable terms, purchased the Dublin Society's premises in Hawkins Street, then used as the Mendicity Asylum, on which a large and elegant theatre has been constructed; but it is not well attended, unless during the extraordinary excitement of first-rate performers, particularly singers. A building called the Arena, set up in Abbey Street for equestrian performances, after having been closed for some years, was taken as their place of meeting by the Dublin Trades Political Union. Shortly after the opening of the Lying-Inn Hospital, an adjoining suite of rooms was splendidly fitted up for balls, concerts, and assemblies. The principal is a circular hall eighty feet in diameter, called the Rotunda; the others, of smaller dimensions, are used as music and supper-rooms. They communicate with the interior of Rutland Square, and were originally thrown open on Sunday evenings as a place of relaxation, where the respectable part of society met together to walk, to look at one another, and to take refreshments. These promenades, as they were called, were ultimately put down by the interference of the clergy. The rooms have since been used for concerts, public meetings, particularly of religious societies, and latterly for auction rooms. The gardens are opened two evenings in every week, and lighted with illuminated lamps, during the summer season. Military bands attend, and rope-dancers and tumblers occasionally exhibit. The attractions thus held out have been found sufficient to draw together occasionally a large concourse of company. The profits arising from the trifle paid for admission are applied to the use of the hospital.

The town residence of the Marquis of Waterford, in Marlborough Street, and that of the Earl of Charlemont, in Rutland Square, are fine buildings. The latter contains a large and choice library, particularly rich in continental literature, some fine antiques and statues, and a good collection of pictures.

Steam navigation has considerably augmented the concourse of strangers to Dublin, and consequently increased the number of hotels, and improved their management. The Commercial Hotel, on Usher's Quay, which forms part of a large pile of buildings, intended for a mart for native manufactures, is remarkable for a colonnade in front;

and Gresham's, in Sackville Street, is a splendid and well-appointed concern.

There are but two public monuments worthy of particular notice,—Nelson's pillar in the centre of Sackville Street, which is 108 feet high, surmounted by a colossal statue of Nelson, and raised at an expense of L.6856; and the Wellington memorial in the Phoenix Park, near its entrance, a stupendous obelisk 205 feet in height, and not yet finished.

At the north-western extremity of the city, the Phoenix Park, an inclosure containing about 1000 acres, belonging to the crown, is thrown open for the recreation of the citizens. Reviews of the garrison also take place in it. It contains the lord lieutenant's lodge, and the residences of some of the public officers. The name is derived from one of the town-lands, of which it is formed. The communications from Dublin to the interior are maintained by the mail coaches, thirteen of which leave the city every day; and by numerous stage-coaches, caravans, and public jaunting cars. These latter vehicles also afford a convenient and economical, though by no means elegant, mode of conveyance to visit the picturesque and romantic scenery that on all sides embellishes the outlets of this beautiful city. Dublin is situated in long. 6. 21. W. and lat. 53. 23. N., and is distant from London 300 miles in a direct line, 339 miles by Holyhead, and 350 by Liverpool in a direction nearly west-north-west.

DUBNO, a circle in the Russian province of Volhynia. It is bounded on the north-west by Luzk, on the north-east by Rowno, on the east by Ostrog, on the south by Kremenez, and on the south-west by Austrian Galicia. It is the most fertile part of the rich province to which it belongs, is watered by the Slyr, and yields abundant crops of wheat, flax, tobacco, and rye. The capital, of the same name, is situated on the river Irwa. It is a large ill-built town, chiefly consisting of wooden houses, with crooked and ill-paved streets, and contains 5650 inhabitants, a great proportion of whom are Jews. Long. 25. 35. E. Lat. 50. 26. N.

DUBOI, a town of Hindustan, in the province of Gujerat and district of Chumpaneer, situated in a low and marshy situation. Here are the remains of a Hindu city of great antiquity. The fortifications which surround it are nearly three miles in circumference. It is forty miles north-east from Broach. Long. 73. 35. E. Lat. 22. 4. N.

DUBOS, JEAN-BAPTISTE, an eminent French author, was born at Beauvais in December 1670. At first he applied himself to theology, but soon renounced this pursuit for the study of public law, and of the political interests of Europe. M. de Torcy, when minister of foreign affairs, employed him with advantage in several secret negotiations; and both the regent and Cardinal Dubos made the same use of his talents, with the same success. Having retired from the field of politics, he entered upon that of history and literature; and, in 1720, his works opened to him the doors of the French academy, of which, in 1722, he was appointed perpetual secretary, in the room of M. Dacier. He died at Paris on the 23d of March 1742, at the age of seventy-two, repeating as he expired the well-known remark of an ancient, "Death is a law, not a punishment." According to Dubos, "there are three things which ought to console us for parting with life; the friends whom we have lost, the few persons worthy of being loved whom we leave behind, and lastly, the recollection of our follies, with the certainty that we shall commit no more." His first work was *L'Histoire des quatre Gordiens, prouvée et illustrée par des Médailles*, Paris, 1695, 12mo. The common opinion, which only admits three emperors of this name, has prevailed in spite of all the efforts of his erudition and criticism. About the commencement of the war

Dubno

Dubos.

Dubris
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Ducas.

of 1701, being charged with different negociations both in Holland and in England, in order if possible to engage these powers to adopt a pacific line of policy, he, in order to promote the objects of his mission, published a work entitled *Les Intérêts de l'Angleterre mal entendus dans la Guerre présente*, Amsterdam, 1703, 12mo. But as this work contained indiscreet disclosures, of which the enemy took advantage, and predictions which were not fulfilled, a wag took occasion to remark that the title ought to be read thus: *Les Intérêts de l'Angleterre mal entendus par l'Abbé Dubos*. His next work was *L'Histoire de la Ligue de Cambray*, Paris, 1709, 1728, and 1785, 2 vols. 12mo. This history, says Voltaire, is profound, political, interesting; it makes us acquainted with the manners and usages of the time, and is a model of its kind. In 1734 he published his *Histoire Critique de l'établissement de la Monarchie Française dans les Gaules*, 3 vols. 4to; a work the object of which was to prove that the Franks had entered the Gauls, not as conquerors, but at the request of the nation, which, according to him, had called them in to govern it. But this system, though unfolded with a degree of skill and ability which at first procured it many zealous partizans, was victoriously refuted by Montesquieu at the end of the thirtieth book of the *Esprit des Loix*. "C'est un colosse," said Montesquieu, "qui a de pieds d'argile, et c'est parce que les pieds sont d'argile que le colosse est immense. Si le système de M. l'Abbé Dubos avait eu de bons fondemens, il n'aurait pas été obligé de faire trois mortels volumes pour le prouver; il aurait tout trouvé dans son sujet; et sans aller chercher de toutes parts ce qui en était très loin, la raison elle-même se serait chargée de placer cette vérité dans la chaîne des autres vérités. L'histoire et nos lois lui auraient dit: 'Ne prenez pas tant de peine; nous rendrons témoignage de vous.'" His *Réflexions critiques sur la Poésie et sur la Peinture*, published for the first time in 1719, 2 vols. 12mo, but often reprinted in three volumes, constitute one of the works in which the theory of the arts is explained with the utmost sagacity and discrimination. "All artists," says Voltaire, "read it with advantage. It is the most useful book which has ever been written on the subjects of which it treats, in any nation of Europe. The excellence of the work consists in this, that it contains few errors, and many reflections which are just, novel, and profound. It is not a methodical book; but the author thinks, and makes others think. He was, however, ignorant of music; he had never been able to make verses, and he had not a single picture in his possession; but he had read, seen, heard, and reflected much." Besides the works above enumerated, a manifesto of Maximilian, elector of Bavaria, against Leopold, emperor of Germany, relative to the succession in Spain, has been attributed to Dubos, chiefly, we believe, by reason of the excellence of the style, which has been greatly commended. (A.)

DUBRIS, in *Ancient Geography*, a town of Britain; now *Dover*, from *Dovoria* of the lower age, and a port-town in Kent, opposite to Calais.

DUCAL, in general, something belonging to a duke. See DUKE.

The letters patent granted by the senate of Venice were called *ducal*; and so also were the letters written in the name of the senate to foreign princes. The denomination of ducal is derived from the circumstance that, at the beginning of such patents, the name of the duke or doge was written in capitals. The date of ducals is usually in Latin, but the body is in Italian. In 1716 a courier was dispatched with a ducal to the emperor, returning him thanks for renewing the treaty of alliance with the republic of Venice, against the Turks.

DUCAS, a learned Greek, who wrote a history of what

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passed under the last emperors of Constantinople, until the capture of that city, and the fall of the eastern empire. This work, which is esteemed, was printed at the Louvre in 1649, with the Latin translation and notes of Boillaud.

DUCAT, a foreign coin, either of gold or silver, struck in the dominions of a duke. The origin of ducats is referred to one Longinus, governor of Italy, who, revolting against the emperor Justin the Younger, made himself duke of Ravenna, and called himself *Exarcha*, that is, *without lord or ruler*; and, in order to show his independence, struck pieces of money of very pure gold in his own name, and with his own stamp, which, as Procopius relates, were called *ducatti*, ducats. After him, the first who struck ducats were the Venetians, who called them *zecchini*, or *sequins*, from Zecca, the place where they were first struck. This was about the year 1280, and in the time of John Dandolo. But we have pretty good evidence that Roger king of Sicily had coined ducats as early as 1240; and Du Cange scruples not to affirm that the first ducats were struck in the duchy of Apulia in Calabria. See MONEY.

DUCATOON, a silver coin, struck chiefly in Italy, particularly at Milan, Venice, Florence, Genoa, Lucca, Mantua, and Parma, though there are also Dutch and Flemish ducatoons. See MONEY.

DUCENARIUS, in *Antiquity*, an officer in the Roman army, who had the command of two thousand men. The emperors had also ducenarii among their procurators or intendants, called *procuratores ducenarii*. Some say that Ducenarii were those whose salary was two hundred sesterces; as in the games of the circus, horses hired for two hundred sesterces were called *ducenarii*. Others hold that ducenarii were those who levied the two hundredth penny, or the officers appointed to inspect the raising of that tribute. In the inscriptions at Palmyra, the word *ducenarius*, in Greek *δουκηνάριος*, occurs very frequently.

DUCENTESIMA, in *Antiquity*, a tax of the two hundredth penny, exacted by the Romans.

DUCHAL, JAMES, D.D. a pious and learned dissenting minister, was born in Ireland, and finished his studies at the university of Glasgow, which afterwards, from a regard to his merit, conferred on him the degree of doctor of divinity. He resided ten or eleven years at Cambridge as the pastor of a small congregation, and there enjoyed his beloved retirement, with the advantage of books and of learned conversation, which he improved with the greatest diligence. On Mr Abernethy's removal from Antrim he succeeded him there, and on that gentleman's death he again succeeded him as a minister of a dissenting meeting-house in Wood Street, Dublin. In this situation he continued till his death, which happened on the 4th of May 1761, when he had completed his sixty-fourth year. He published a volume of excellent discourses on the presumptive arguments in favour of the Christian religion, together with many occasional tracts; and after his death a number of his sermons were published, in three volumes 8vo.

DUCHENPARAH, a town of Cashmere, the capital of a district of the same name, situated at the foot of a ridge of high mountains which bound Cashmere on the side of Great Thibet. Long. 74. 58. E. Lat. 34. 51. N. The district is situated between the thirty-fourth and thirty-fifth degrees of north latitude.

DUCHOWTSCHINA, a circle in the Russian government of Smolensko, north-east from the city, well watered and cultivated. The capital, of the same name, is situated on two rivers, the Ehewistitza and the Zarrewitza, which here join. The inhabitants amount to 950 only.

DUCHY, in *Geography*, an appellation given to the dominions of a duke.

Ducat
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Duchy.

Duchy
Court
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Duclos.

DUCHY Court, a court where all matters belonging to the duchy or county palatine of Lancaster are decided by decree of the chancellor of that court. The origin of this court was in the time of Henry IV. who obtained the crown by the deposition of Richard II. and having taken the duchy of Lancaster by descent, in right of his mother, became seised thereof as king, not as duke; so that all the liberties, franchises, and jurisdictions of the said county passed from the king by his great seal, and not by livery or attornment, as the earldom of March, and other possessions, which descended to him by other ancestors than the king's did. Henry IV. by authority of parliament, dissevered the possessions, liberties, &c. of the said duchy from the crown, but Edward IV. restored them to their former nature. The officers belonging to this court are, a chancellor, attorney-general, receiver-general, clerk of the court, and messenger, besides the assistants, such as an attorney in the exchequer, another in chancery, and four counsellors.

DUCK. See ORNITHOLOGY.

DUCK, Stephen, originally a common thrasher in a barn, was born about the beginning of the eighteenth century. By his poetical talents he first attracted the notice of some gentlemen at Oxford; and having been recommended to Queen Caroline, he, under her patronage, took orders, and was preferred to the living of Byfleet in Surrey. Swift, who, one would have thought, might have overlooked such an object as Duck, but whose splenetic humour prompted him to be satirical for any reason or none, chose to feel piqued at the generosity displayed by the queen, and under the influence of this feeling wrote the following bitter Epigram "on Stephen Duck the thrasher and favourite poet:"

The thrasher Duck could o'er the queen prevail;
The proverb says, "No fence against a flail."
From threshing corn he turns to thresh his brains,
For which her majesty allows him grains.
Though 'tis confess'd that those who ever saw
His poems, think them all not worth a straw.
Thrice happy Duck, employ'd in threshing stubble!
Thy toil is lessened, and thy profits double.

Duck's abilities, however, were much more conspicuous in his primitive station than in his advancement, though it is said he was not disliked as a preacher. At length, having fallen into a low-spirited melancholy way, probably owing to his change of life, and the cessation of his usual labour, he in a fit of insanity threw himself from a bridge near Reading, into the Thames, and was drowned. This unhappy accident occurred in the year 1756.

DUCKING, plunging in water, a diversion anciently practised among the Goths by way of exercise; but among the Celts, Franks, and ancient Germans, it was a sort of punishment for persons of scandalous lives.

DUCKINSHAHABAZPOOR, a large island of Hindustan, in the province of Bengal, situated at the junction of the great river Meyna with the sea, thirty miles in length by fifteen in average breadth. It lies low, and during the rains is almost wholly submerged.

DUCKUP, at sea, is a term used by the steersman when the mainsail, foresail, or spritsail hinders his seeing to steer by a landmark; upon which he calls out, *Duckup the clew-lines of these sails*, that is, haul the sails out of the way.

DUCLOS, CHARLES PINEAU, a French author of some celebrity, was born at Dinant, in Bretagne, in the year 1704. At an early age he was sent to study at Paris. The imprudence of youth, and his love of pleasure, led him at first to contract certain intimacies which were little suited to his circumstances; but having afterwards disengaged himself from these, he courted the society of

all the wits of his time, by whom he was well received. He became a member of that club, or association of young men, who published their juvenile productions under the titles of *Récueil de ces Messieurs*, *Etrennes de la St Jean*, *Œufs de Paques*, &c. The romance of *Acajou and Zirphile*, which was composed after a series of plates which had been engraved for another work, was one of the fruits of this association, and was produced in consequence of a sort of wager amongst its members. The epistolary dedication to the public, which was prefixed to this trifle, gave umbrage to some, in consequence of the flippant tone which the author assumed. Duclos had previously written two other romances, which were more favourably received: *The Baroness de Luz*, and the *Confessions of the Count de ****. His first serious publication was the *History of Louis XI*. The style of this work is dry and epigrammatical, but the author has displayed in it considerable powers of research, and preserved the character of an impartial historian. The reputation of Duclos as an author was confirmed by the publication of his *Considérations sur les Mœurs*, a work which is much praised by Laharpe, and not without justice; for although the style, as in most of the writings of this author, is rather stiff and sententious, the book undoubtedly contains a great deal of just and ingenious reflection. It was translated both into English and German. The *Mémoires pour servir à l'Histoire du dix-huitième Siècle*, which were intended by the author as a sort of sequel to the preceding work, are nevertheless much inferior both in respect of style and matter, and are, in reality, little better than a kind of romance. In consequence of his *History of Louis XI* he was appointed historiographer of France, when that place became vacant on Voltaire's retirement to Prussia. His *Secret Memoirs of the Reign of Louis XIV. and Louis XV.* and his *Considerations on Italy*, were not published until after the revolution. The former work is highly spoken of by Chamfort.

Duclos became a member of the Academy of Inscriptions in 1739, and of the French Academy in 1747. Of the latter he was appointed perpetual secretary in 1755. Both of these academies were indebted to him, not only for many valuable contributions, but likewise for several useful regulations and improvements. As a member of the Academy of Inscriptions, he composed several memoirs on the Druids; on the origin and revolutions of the Celtic and French languages; on trial by battle, and proof by ordeal; and on scenic representations, and the ancient drama. As a member of the French Academy, he assisted in compiling the new edition of the *Dictionary* which was published in 1762; and he made some just and philosophical remarks on the *Port Royal Grammar*. On several occasions he resolutely supported the honour and prerogatives of the societies to which he belonged, and maintained the respectability of the literary character in general. He used to say of himself, "I shall leave behind me a name dear to literary men." His fellow-citizens, whose interests he always supported with zeal, appointed him mayor of their town in 1744, although he was resident at Paris. He was afterwards elected deputy from the commons to the assembly of the states of Bretagne; and upon the requisition of this body the king granted him letters of nobility.

In 1766 he was advised to retire from France for some time, in order that the government might have an opportunity of forgetting some opinions which he had hazarded, on the subject of the dispute between the Duc d'Aiguillon and M. de la Chalotais, the friend and countryman of Duclos. Accordingly he set out for Italy, and, on his return, he wrote an account of his travels, which is also praised by Chamfort. He died at Paris on the 26th of March 1772, in the sixty-ninth year of his age.

Duclos.

Duct
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Dudley.

The character of Duclos, although it exhibited many singular traits, was still respectable, whether we consider him as a man or as an author. Rousseau described him very laconically as a man, *droit et adroit*. In his manners he displayed a sort of bluntness in society, which frequently rendered him disagreeable; and his caustic wit on many occasions created enemies. To those who knew him, however, he was a pleasant companion. He was a great lover of anecdotes, and had the talent of relating them in a very agreeable manner. A considerable number of his good sayings have been preserved by his biographers.

A complete edition of the works of Duclos was published by Desessarts, at Paris, in 10 vols. 8vo, 1806. (See *Biog. Universelle*.)

DUCT, in general, denotes any tube or canal. It is a term much used by anatomists.

DUCTILITY, in *Physics*, a property possessed by certain solid bodies; it consists in their yielding to percussion or pressure, and receiving different forms, without breaking.

Some bodies are ductile both when they are hot and when they are cold, indeed in all circumstances. Such are metals, particularly gold and silver. Other bodies are ductile only when heated to a sufficient degree; such as wax and other substances of that kind, and glass. Other bodies, again, particularly some kinds of iron, called by the workmen *red short*, brass, and some other metallic mixtures, are ductile only when cold, and brittle when hot. The degrees of heat requisite to produce ductility in bodies of the first kind, vary according to their different natures. In general the heat of the body must be such as is sufficient to reduce it to a middle state, betwixt solidity and perfect fusion. As wax, for instance, is fusible with a very small heat, it may be rendered ductile by a still smaller; and glass, which requires a most violent heat for its perfect fusion, cannot acquire its greatest ductility until it is made perfectly red hot, and almost ready to fuse. Lastly, some bodies are made ductile by the absorption of a fluid. Such are certain earths, particularly clay. When these earths have absorbed a sufficient quantity of water to bring them into a middle state betwixt solidity and fluidity, that is, to the consistence of a considerably firm paste, they have then acquired their greatest ductility. Water has precisely the same effect upon them in this respect that fire has upon the bodies above mentioned.

DUDLEY, EDMUND, a celebrated lawyer and statesman in the reign of Henry VII., who with Sir Richard Empson, another lawyer of the same stamp, assisted in filling that rapacious monarch's coffers by arbitrary prosecutions of the people on old penal statutes. Dudley and Empson were beheaded on the accession of Henry VIII. in order to pacify the clamours of the people for justice.

DUDLEY, John, Duke of Northumberland, son of the above, a statesman memorable in the English history for his unsuccessful attempt to place the crown on the head of his daughter-in-law, Lady Jane Grey, who fell a victim to his ambition, was born in 1502, and beheaded in 1553. Ambrose, his eldest son, was a brave general and able statesman under Queen Elizabeth, and received the appellation of "the good Earl of Warwick." Henry, the duke's second son, was killed at the siege of St Quintin. Robert, the third son, a man of bad character, was created Earl of Leicester, and became one of Queen Elizabeth's favourites. His fourth son was the unfortunate Lord Guildford Dudley, whose only crime was his being the husband of Lady Jane Grey, an offence for which he was beheaded in 1554.

DUDLEY, Sir Robert, as he was called in England, and, as he was styled abroad, *Earl of Warwick and Duke of*

Northumberland, was the son of Robert above mentioned, by the Lady Douglas Sheffield, and born at Sheen in Surrey in 1573, where he was carefully concealed, in order to prevent the queen acquiring a knowledge of the earl's engagement with his mother. He was entered of Christ Church, Oxford, where he remained some time. In 1588 his father died, and left him, after the decease of his uncle Ambrose, his castle of Kenilworth, the lordships of Denbigh and Chirk, and the bulk of his estate, which before he was of age he in a great measure enjoyed, notwithstanding the enmity borne him by the Countess Dowager of Leicester. He was at this time one of the finest gentlemen in England; and having a particular turn for navigation, he fitted out a small squadron at his own expense, with which he sailed to the river Orinoco, and took and destroyed nine sail of Spanish ships. In 1595 he attended the Earl of Essex and the lord high admiral of England in their expedition against the Spaniards, and, for his gallant behaviour at the taking of Cadiz, he received the honour of knighthood. He now endeavoured to prove the legitimacy of his birth, in order to be entitled to his hereditary honours. But being overpowered by the interest of the Countess Dowager of Leicester, he applied for a license to travel; and being well received at the court of Florence, he resolved to continue there, notwithstanding his receiving a letter of recall; upon which his whole estate was seized by King James I. and vested in the crown. At the court of Cosmo II. great duke of Tuscany, he discovered those great abilities for which he had been admired in England, and was at length made chamberlain to his serene highness's consort. Whilst in this situation, he contrived several methods of improving shipping; introduced new manufactures; and by other services obtained so high a reputation that, at the desire of the archduchess, the Emperor Ferdinand, in 1620, created him a duke of the holy Roman empire. He afterwards drained a vast tract of morass between Pisa and the sea, and raised Leghorn, which was then a mean and insignificant place, into a large and beautiful town, improving the haven by a mole, which rendered it both safe and commodious; and having engaged his highness to declare it a free port, he by his influence and correspondence drew many English merchants to settle and set up houses there, which proved of very great service to his native country, as well as to the Spaniards. He was also the patron of learned men, and held a high place himself in the republic of letters. His most celebrated work is his *Del Arcano del Mare*, Firenze, 1630, 1646, folio. This work, which has always been scarce, has now become extremely rare. There is a copy in the British Museum, dated 1661, and called the second edition; but that which we have seen and examined belongs to the Society of Writers to the Signet, Edinburgh, whose valuable and well-selected library contains many works of the greatest merit, and literary gems and rarities. The work, which consists of a collection of tracts, comprehends a great number of projects for the improvement of navigation and commerce, with the charts and plans relative thereto; all of them schemes which, considering the time when they were devised, are quite remarkable for the boldness and originality with which they are conceived, and the extent of scientific acquirements which they exhibit.

DUDLEY, a large town of the hundred of Halfshire, in the county of Worcester, 130 miles from London. It contains two parishes, with their respective churches. The country around it abounds with coal and iron. The chief employment consists in making nails and other hardware. It is a very ancient town, the castle of which is reported to have been built in the seventh century, by a Saxon prince Dodo or Duddo. There is a large market held every Saturday. The inhabitants in 1801 amounted to

Dudley.

Duel.

10,107, in 1811 to 13,925, in 1821 to 18,211, and in 1831 to 23,043.

DUEL, a combat between two persons. To distinguish it from the unpremeditated combat or *rencontre*, it must take place at a time and place appointed in consequence of a cartel or challenge, and generally in presence of two or more witnesses or umpires.

The word is derived from *duellum*, used by the barbarous Latin writers *quasi duorum bellum*; and, as a judicial trial, it has been defined "singularis pugnus inter duos ad probandum litem, et qui vicit probasse intelligitur." (*Fleta*.)

The origin of duelling may be traced to that barbarous state of society in which personal courage was followed as the ruling principle, and esteemed as the noblest ornament, of life. Under the influence of such principles, the considerations of justice and humanity were little regarded; and patience under injuries being branded as infamous and cowardly, men were naturally impelled, not only to avenge their own wrongs, but to gratify their private resentments, at the point of the sword.

Before the dawn of Christianity had thrown its light upon the interesting doctrine of a providence superintending the affairs of men, the belief of an adequate distribution of rewards and punishments in the present life seems to have been generally received. The rich, the prosperous, and the happy, were apt to be considered as the peculiar favourites of Heaven; whilst disease, misfortune, and sudden or violent death, were regarded as the inflictions of divine vengeance on the crimes of the sufferers. Hence, in a superstitious age, arose the practice of making a direct appeal to the deity in the single combat, under the persuasion that the justice of Heaven would infallibly declare for the innocent, and visit the perjured and the guilty with dishonour and death.

The duel, as a judicial trial, prevailed at an early period amongst the Germans, Danes, and Franks; and by a law instituted in 501, by Gondeband, king of Burgundy, it was allowed in legal proceedings in lieu of swearing.

Louis le Debonnaire was the first French monarch who permitted to litigants the trial by arms; and the same mode of trial was introduced into England, with other Norman customs, by William the Conqueror. It was only used, however, in three cases: in the court martial or court of chivalry, in appeals of felony, and in civil cases upon issue joined in a writ of right; in which last it was the only decision, until Henry II., with consent of parliament, introduced the grand assize. None were exempt from the trial by battle but females, the sick and the maimed, and persons under fifteen or above sixty years of age; ecclesiastics, priests, and monks, being allowed to produce champions in their stead.

The trial by battle, however, soon degenerated into a convenient pretext for gratifying private revenge under sanction of the law, or on pretence of discovering truth and punishing perjury. Under the feudal system it was of course warmly patronized, being but too congenial with the feelings and habits of the fierce and haughty barons, who, uncontrolled by any principles of law or religion, disdained to submit their differences to any arbitration, or to seek any reparation for an injury but by the sword. Arms were the sport, plunder and revenge the business, of their lives. And to such a height did the evils arising from their private quarrels and petty warfare increase, that it became necessary to adopt some means for controlling and directing the torrent of military violence, which threatened to sweep away every feeling of justice and humanity, and subject the peace and comfort of the community to the unrestrained passions of a fierce and lawless aristocracy. Martial societies were accordingly instituted, whose duty it was to protect the weak and defenceless, to relieve the

Duel.

oppressed, to correct abuses, and to promote the public good.

Hence arose chivalry and knight-errantry, which, although they modified in some degree the evil of duelling, by imposing a minute and punctilious system of observances, had yet a tendency to perpetuate the practice, by instituting those false and fantastic principles of honour, the evils of which are still felt in the modern duel. With the code of punctilious regulations, the grounds and motives of the duel were changed and extended. Malice and revenge gave place to the gratification of personal vanity, and the desire of that renown for deeds of arms which was considered as the glory of the age. Tilts and tournaments were the pastime of the nobles, and were not only countenanced by the presence of the prince, who not unfrequently shared the dangers of the field, but graced by the attendance of female beauty and distinction, from whose hands the successful champion received the prize of his achievements, and at whose feet he longed to lay the trophies of his victory. See CHIVALRY.

The tournament continued in high estimation, notwithstanding the many valuable lives sacrificed on the most frivolous occasions, until the middle of the sixteenth century, when the death of Henry II. of France, in a tournament given in honour of his sister's marriage, gave a check to these sanguinary amusements. At this entertainment Henry sent his lance to Count Montgomerie, the captain of his guards, who at first declined the challenge; but on the king repeating his commands, he was compelled to obey. At the encounter, Montgomerie purposely broke his lance against the king's breastplate; but unhappily for the monarch he wore his helmet open, and a splinter of the lance flying up into his eye, pierced his brain. He survived for about a month in great agony, and died on the 10th July 1559. (*Cockburn on Duels*.)

In no country has the duel on private and personal quarrels prevailed to so great an extent as in France. Francis I. encouraged the practice by his well-known determination "that the lie was never to be borne without satisfaction but by a base-born fellow." By his challenge to the Emperor Charles V. he set an example which his high-minded nobles were but too eager to follow; and under the countenance of their monarch their native propensity to the single combat was indulged to an extent which all the power of his successors was scarcely able to control.

The power of the church was frequently exerted to restrain these bloody proceedings, especially by a council at Valentia in 855, and lastly by the council of Trent, session xxv. chap. 19, which excommunicated not only the combatants, but their associates, and even the spectators of the battle; declaring the custom to be detestable, introduced by Satan for the destruction both of body and soul. It adds, that "all advisers, supporters, witnesses, or those in any way concerned, are likewise excommunicated. Princes also who connive at duels are to be deprived of all temporal power, jurisdiction, and dominion over the places where they have permitted duels to be fought."

Philip the Fair, at the close of the thirteenth century, forbade all gages or pledges of battle; but this prohibition was afterwards relaxed in several instances, and in 1306 a royal ordonnance was published, prescribing rules, conditions, and ceremonies for the combat.

In the reign of Henry II. a noted duel was fought in the king's presence between Guy Chabot de Jarnac and Francis de la Chastaignerie, in which the latter was slain; and on this occasion Henry is said to have taken an oath never to allow another during his reign. An edict was published accordingly; but this, which appears to have been the first royal prohibition of the duel, was produc-

Duel. tive of no good effects. The prohibition indeed arose rather from the king's grief for the loss of his friend Chastaignerie than from any desire on public grounds to abolish the custom; and it appears rather to have aggravated the evil, by increasing the number of private duels: for the same punctilious notions of honour from which the duel generally originated, and the same dread of the imputation of cowardice which kept it alive, were still entertained; and as the royal permission, without which the duel had formerly been high treason, could not now be obtained, each man became the judge in his own cause; and in those delicate cases, of which the law could take no cognizance, the point of honour was more likely to be stretched than curtailed.

The parliament of Paris in 1599 declared all persons who had assisted or been present at the prosecution of these unlawful quarrels to be rebels to the king, transgressors of the laws, and disturbers of the public peace.

Henry IV., during the first eighteen years of whose reign no less than four thousand gentlemen are said to have perished by the duel, alludes in his edict at Blois, 1602, to the disorders arising from this barbarous custom; and in 1609 he added to the penalties already imposed, punishment by death, confiscation of goods, fines, imprisonment, and degradation from honour, on all who were in any way concerned in these combats, not only principals and seconds, or bearers of challenges, but spectators, and even those who, being accidentally present, did not interfere to prevent bloodshed. The severity of these edicts might have contributed greatly to diminish the evil; but unfortunately they arose rather from the complaints of the people, and the persuasions of the Duke of Sully, than from any desire on the part of Henry himself to abolish a custom for which he privately entertained a great partiality, as was evident from the readiness with which he granted pardons to offenders, and even privately encouraged particular duels. He readily gave permission to Crequi to fight Don Philip of Savoy, and even added this encouraging compliment, "If I were not a king I would gladly offer myself to be your second."

It was not to be expected that laws, however severe, the open violation of which was thus countenanced by the monarch himself, could be productive of any beneficial effects; and we find the passion for the single combat continuing unabated during the reign of the succeeding monarch Louis XIII. To such extent indeed did it prevail, that the common inquiry when acquaintances met was not, "what is the news to-day," but "who fought yesterday;" and Lord Herbert, who was ambassador at the court of Louis, says, that "there is scarce a Frenchman worth looking on who has not killed his man in a duel."

Two noblemen, however, Montmorenci count de Boutteville, the most renowned duellist of the day, and the Marquis de Beuoron, persisting to fight in defiance of the royal interdict, were tried according to law, and both beheaded. This execution caused for a time a cessation of the sanguinary custom; but it was reserved for Louis XIV. to give the first effectual check to the continuance of the practice.

During the minority of this prince a very desperate battle was fought between the Dukes de Beaufort and de Nemours, each attended by four friends. The seconds of the Duke de Nemours were the Marquis de Villars, the Chevalier de la Chaise, D'Uzerches, and Compan; and the Duke de Beaufort was attended by D'Henricourt, De Ris, Buri, and Brillet. They fought five against five, with swords and pistols. Nemours was shot by Beaufort, the Marquis de Villars killed D'Henricourt, and D'Uzerches slew De Ris: the rest were only slightly wounded.

This, with another desperate encounter fought in 1663,

four against four, determined the king on taking some decided step to prevent the recurrence of such disgraceful and bloody quarrels. The famous edict published in 1679, with the solemn agreement entered into by the principal nobility, "that they would never fight a duel on any pretence whatever," and the firmness of Louis in refusing pardon to all offenders, contributed more to restrain this unhappy propensity than all the efforts of his predecessors.

The practice of duelling in England, although it never prevailed to such an extent as in France, may be traced to the same causes which gave rise to it on the Continent. The duel, as we have already mentioned, was early in use amongst the Franks and Normans, and was probably by them introduced into England.

One of the latest instances of the trial by battle occurred in the reign of Elizabeth in the year 1571, of which Sir Henry Spelman, who was eye-witness, gives an account of the whole proceedings, which were conducted, he says, "*non sine magna jurisconsultorum perturbatione.*" A proceeding having been instituted in the Court of Common Pleas, for recovery of some manorial rights in the Isle of Hartic, Kent, the defendant offered to maintain his right to possession by the duel. The petitioners accepted the challenge, and as the court does not appear to have had the power of refusal, champions were appointed, and all the requisite forms adjusted. The queen, to prevent bloodshed, had commanded the parties to compromise; but, anxious at once to save the credit of the defendant, who demanded the combat, and to support the authority of the law, which enjoined its being fulfilled, the ceremony of the duel was allowed to proceed. On the appointed day the justices of the common pleas and the counsellors appeared at Tothil Fields as umpires of the combat; but as the petitioners did not appear to acknowledge their champion, they were nonsuited, and victory declared for the defendant. Thus ended the last judicial combat we read of in a civil case. Another, however, occurred in the court of chivalry in 1631, and in the county palatine of Durham in 1638; and the trial by battle was claimed so late as 1818, in the case of Thornton v. Ashford, in an appeal of murder.

But although the duel was disused in judicial proceedings, the fantastic notions of honour to which it gave rise still prevailed; and as the law could take no cognizance of points of honour and personal affronts, private duelling rather increased in the reigns of Elizabeth and James I.

During the civil wars the minds of men were too much occupied with the agitating events of the time to pay much attention to the settlement of points of etiquette; and as the contest was between the commonalty and all that was royal and noble in the land, private feuds were forgotten, and those who would have turned their swords against each other in private quarrel, disdained to employ them in such a cause against men of mean birth and ignoble sentiment.

The custom, however, again gained ground after the restoration of Charles II.; and although he did issue a proclamation to put the existing laws in force, this object was defeated by his great laxity in pardoning offenders.

In consequence of a duel between the Duke of Hamilton and Lord Mohum in 1712, which was fought with the greatest ferocity and apparent determination of murder, and in which both parties were killed, the subject again came under the consideration of government. At the meeting of parliament in the following year, the queen's speech alluded to the subject in this sentence: "the practice of duelling requires some speedy and effectual remedy." No precise notice was taken of this part of the

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speech in the address from the House of Commons; and a bill which was brought in for the more effectual restraint of the duel was thrown out on a second reading.

Since the fashion of wearing the sword has been abandoned, private duels have become less frequent in this country, and we have not now to deplore the numerous and often fatal rencontres which, during the last century, were so frequently begun and concluded in the moment and heat of passion, and not seldom on the most frivolous occasions. Such was the duel between Lord Byron and Mr Chaworth in 1765, which originated in a dispute during dinner about the quantity of game on their respective manors. The parties retired to an adjoining room, where they fought by the uncertain light of one small tallow candle, and Mr Chaworth, although the more expert swordsman, was mortally wounded.

By the laws of this country all the parties concerned in a duel which terminates fatally are guilty of murder, however fairly the combat may have been conducted, and however great the provocation.

The suddenness of the provocation, and the agitation of excited feelings, which in other cases may be pled in extenuation of the crime, cannot be urged in favour of those who, after ample time for deliberation, meet for the avowed purpose of murder. It is seldom indeed that the extreme penalty is inflicted, except in cases where unfair advantage has been taken, or which are otherwise attended with peculiar aggravation.

The duel between Major Campbell and Captain Boyd, for which the former was executed in 1808, is well known, and was considered as little better than deliberate assassination. But in the case of Lieutenant Blundell, who was killed in a duel at Carisbrooke Castle, in the Isle of Wight, in 1813, every thing appears to have been conducted with perfect fairness; yet the surviving principal, the seconds, and two others who were considered accessory, were convicted of murder at the Hampshire assizes, and sentenced to death; and although the royal pardon was obtained, they were all dismissed from his majesty's service.

Foster expresses the following opinion: "Deliberate duelling, if death ensueth, is in the eye of the law murder. For duels are generally founded on deep revenge. And though a person should be drawn into a duel, not upon a motive so criminal, but merely upon a punctilio of what swordsmen falsely call honour, that will not excuse. For he that deliberately sheddeth the blood of another, upon a private quarrel, acteth in defiance of all laws, human and divine, whatever his motive may be." And Judge Blackstone: "When both parties meet avowedly with an intent to murder, thinking it their duty as gentlemen, and claiming it as their right, to wanton with their own lives, and those of their fellow-creatures, without any warrant or authority from any power either divine or human, but in direct contradiction to the laws both of God and man, the law has justly fixed the crime and punishment of murder on them, and on their seconds also."

In a moral point of view the practice admits of no defence, for the very principle on which the duellist proceeds is one which, if universally adopted, would be subversive of all good order, namely, that an individual may be the judge of his own cause, and the avenger of his own wrongs. The legislature has provided a reparation for all those injuries which the wisdom of legislators has thought it reasonable to redress; and for an individual, or body of individuals, to adopt a law for the regulation of their own conduct, differing in spirit and opposed in principle to the laws of the country, is alike inconsistent with sound moral and political philosophy. Such is the law of honour, as it is called, a law by which no wise or sober-minded man would desire to regulate his life: it prescribes none of

those duties which we owe to God as his creatures, it admits or connives at many direct violations of his laws, and it imposes no restraint on that indulgence of the sensual passions, which is degrading to human nature, injurious to society, and opposed to all that is really good and honourable in the character of man. But unfortunately "the law of honour having annexed the imputation of cowardice to patience under an affront, challenges are given and accepted with no other design than to prevent or wipe off this suspicion, and without any other concern than to preserve the duellist's own reputation and reception in the world."

Every man of experience in the world must be convinced of the truth of this remark. And it is not one of the least evils of this system, that the word *honour*, which, rightly understood, denotes all that is truly noble and virtuous, should be prostituted as a pretext for gratifying the most malignant of human passions, or as a cover for that moral cowardice, the fear of being thought afraid.

"Duels," says Sir George Mackenzie, "are but illustrious murders. It is an imperious crime, which triumphs both over public revenge and private virtue, and tramples boldly upon the laws of the nation and the life of our enemy. Courage thinks law here to be but pedantry, and honour persuades men that obedience here is cowardice." It has been the aim of every moral writer to expose the folly, and of every wise legislature to check the prevalence, of this pernicious practice; yet so powerful is the domineering influence of fashion, that a custom originating in barbarism, and cherished only by pride and selfishness, has for ages stood its ground against all the arguments of reason and religion. Its prevalence is indeed abated in our country, and it is to be hoped there are not many men in the present day who fight for the mere gratification of revenge; but it is to be feared that there are not a few who, condemning the custom in their hearts, are yet compelled to "go as an ox to the slaughter," and to "die as a fool dieth," under the dread of an imputation of cowardice, which they would not otherwise deserve. Nor is it likely that the duel will ever be entirely abolished by the law as at present administered. Death, which the law of honour views as but an adequate reparation for an offensive word, is thought too severe a punishment for what the laws of God and man both declare to be murder. The penalty, therefore, is seldom inflicted; and where many are acquitted, all will hope to escape.

"Death," says Mr Addison, "is not sufficient to deter men who make it their glory to despise it; but if every one who fought a duel were to stand in the pillory, it would quickly diminish the number of these imaginary men of honour, and put an end to so absurd a practice."

DUERO, or DOURO, a river of Spain and Portugal. It rises in the Sierra de Urbion, not far from Durcula, in Soria, and empties itself into the ocean at St João da Foz, below Oporto. Its course through Spain is 306 miles, and through Portugal 185. In the latter kingdom it is not navigable more than seventy-four miles, on account of the rapidity of its course. The streams which flow into it are the Pisuerga, the Esla, the Adaja, the Valderaguay, the Yeltes, the Agueda, the Coa, the Sabor, the Tua, and the Tamaga.

DUFF'S GROUP, a range of islands in the South Pacific Ocean, about eleven in number, extending fourteen or fifteen miles in a direction north-west to south-east. These islands were discovered by Captain Wilson in the course of his missionary voyage in the ship Duff. The largest two were covered with wood, the others appeared barren. The natives appeared shy and apprehensive of strangers.

DUGDALE, SIR WILLIAM, an eminent English antiqua-

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Dugdale.

Duhamel. ry and historian, was born at Shustoke, near Coleshill, in Warwickshire, in 1605. He was introduced into the herald's office by Sir Christopher Hatton, and ascended gradually through all the degrees, until he became garter principal king at arms. His chief work is the *Monasticon Anglicanum*, in 3 vols. folio, containing the charters and descriptions of all the English monasteries, adorned with engravings; a work in which he was assisted by Mr Roger Dodsworth. Nor are his antiquities of Warwickshire less esteemed. He wrote likewise, the *History of St Paul's Cathedral*, London, 1658, folio; a *History of Embanking and Draining*, London, 1662, 1675, 1676, folio; a *Baronage of England*; and he completed the second volume of Sir Henry Spelman's *Councils*, with a second part of his Glossary. He died on the 10th February 1686, in the eighty-first year of his age. His son, Sir John, was norroy king at arms, and published a Catalogue of the English nobility. His daughter Elizabeth was married to Elias Ashmole.

DUHAMEL, DE VRIGNY LE MONCEAU, HENRI LOUIS, author of many valuable works on agriculture, natural history, and the arts, son of Alexander du Hamel, lord of Denainvilliers, and of Ann Trottier, was born at Paris in 1700. His family had formerly emigrated to Holland, but returned to France as early as the year 1400, with the Duke of Burgundy.

He was educated at the College d'Harcourt; but the chief advantage which he derived from his residence there, was a taste for the further acquirement of physical knowledge, which he afterwards pursued with ardour at the Jardin du Roi, having for his fellow-students a number of young men, who afterwards acquired a high degree of celebrity, and among the rest Dufay, Geoffroi, Léméri, Jussieu, and Vaillant. At the age of twenty-eight he obtained the title of adjunct botanist in the Academy of Sciences; in 1730 he became an associate, and in 1738 an academician, having previously been elected a fellow of the Royal Society of London, in the beginning of 1734. Upon his first admission into the list of the academy, his assistance was requested in the investigation of a disease which affected the saffron cultivated in the Gâtinois, where his estate was situated; and he found reason to attribute it to a parasitical fungus attached to the roots of the plant. His memoirs and notes communicated to the academy, as well as his separate publications, are so multitudinous, that the shortest possible enumeration of their subjects can barely be brought within the ordinary limits of a biographical article.

1. *A Disease of Plants*, Acad. Paris, 1728. 2. *The Multiplication of Fruits*, 1728. 3. *The Growth of Plants*, 1729. 4. *Grafting*, 1730. 5. *The Pear Tree*, 1730-1-2. 6. *Soluble Tartar*, 1732-3. 7. *Ether*, 1734. 8. *Salt of Sulphur*, 1734. 9. *Sal Ammoniac*, 3 parts, 1735. 10. *The Purple Dye*, 1736. 11. *The Base of Sea Salt*, 1736. 12. *The Strata of Wood*, 1737. 13. *Frosts*, 1737. 14. *Bones Tinged Red*, 1739. 15. *Polygala as a Pectoral*, 1739. 16. *The Mistletoe*, 1740. 17. *Botanico-meteorological Observations*, continued annually for forty-two years, 1740-1781. 18. *The Union of Fractured Bones*, 2 parts, 1741. 19. *The Strength of Timber*, 1742. 20. *The Growth of Bones*, 5 parts, 1742-3. 21. *Frobenius's Ether*, 1742. 22. *Anatomy*, 1743. 23. *Slips, Layers, and Offsets*, 1744. 24. *Moisture in Oak Timber*, 1744. 25. *A Magnetic Ore*, 1745. 26. *The Preservation of Seed*, 1745. 27. *Magnetising a Bar*, 1745. 28. *Cordage*, 1746. 29. *The Wounds of Trees*, 1746. 30. *Lime*, 1747. 31. *Calcination of a Stone*, 1748. 32. *Ventilation*, 1748. 33. *Plants raised in Water*, 1748. 34. *Gunpowder*, 1750. 35. *The Weight of Ignited Metals*, 1750. 36. *Tull's Agriculture*, 1750. 37. *The Compass*, 1750. 38. *The Strata*

of Trees, 1751. 39. *The Growth of Horns*, 1751. 40. *Bees*, 1754. 41. *Madder*, 1757. 42. *Spontaneous Combustions*, 1757. 43. *Ergot*, 1759. 44. *An Insect Devouring Corn*, 1761; and separately, 12, Paris, 1762. 45. *A Descent of the Barometer*, 1763. 46. *The Tea Plant in Sweden*, 1763. 47. *Inflammable Vapours*, 1763. 48. *Salts in Ashes*, 2 parts, 1767. 49. *Overdriving Animals*, 1768. 50. *Rhubarb*, 1768. 51. *Hair Returning after fifty Years*, 1770. 52. *A Change of the Needle*, 1771. 53. *Variation Compasses*, 1772. 54. *A Monstrous Apple Tree*, 1775. 55. *The Management of Prisons*, 1780.

56. *Observations and Experiments with Madder Root, which has the Faculty of Tinging the Bones of Living Animals of a Red Colour.* *Phil. Trans.* xli. 1740, p. 390.

57. *Traité de la Culture des Terres*, 6 v. 12. Par. 1750. Ac. Par. 1755-7.

58. *Architecture Navale*, 4. Par. 1752, 1758. Ac. Par. 1752. *Avis pour le Transport par Mer des Arbres*, 2d edit. 12. Par. 1753.

59. *Conservation des Grains*, 12. Par. 1753, 1754, 1768. *Supplément*. Par. 1765, 1771. Ac. Par. 1765.

60. *Fabrique des Manœuvres pour les Vaisseaux*. 4. Par. 1757.

61. *Traité des Bois et Forêts*. 8 v. 4. Par. 1755-1767. *Arbres et Arbustes*, 2 v. 1755. *Physique des Arbres*, 2 v. 1758. *Semis et Plantations*, 1760. *Exploitation*, 2 v. 1764. *Transport, Conservation, et Force*, 1767. Ac. Par. 1755, 1758, 1760, 1767, 1768.

62. *Moyen de Conserver la Santé aux Equipages*. 12. Par. 1759. Ac. Par. 1755, 1758, 1759, 1760.

63. *Traité des Arbres Fruitières*. 2 v. 4. Ac. Par. 1768.

64. *Traité des Pêches*, 1769. Jointly with M. de la Marre. Ac. Par. 1769.

65. *Art du Charbonnier*. Par. fol. Noticed Ac. Par. 1761. 66. *De la Fabrique des Ancres*, 1761. 67. *Du Chandelier*, 1761. 68. *De l'Epinglier*, 1761. 69. *De Reduire le Fer en Fil*, 1768. 70. *Du Cirier*, 1762. 71. *De Faire les Enclumes*, 1762. 72. *Du Cartier*, 1762. 73. *De Rafiner le Sucre*, 1764. 74. *Du Drapier*, 1765. 75. *De Faire les Tapis*. 76. *De Friser les Etoffes*, 1766. 77. *Du Couvreur*, 1766. 78. *Du Tuilier Briquetier*. 79. *Du Serrurier*, 1768. 80. *De Préparer le Colle*. 81. *De Faire les Pipes*, 1772. 82. *Du Potier de Terre*, 1774. 83. *Du Savonnier*, 1775.

The earlier part of Mr Duhamel's life was chiefly devoted to the study of vegetable physiology, which he had continued for thirty years before the publication of his principal works. The most original of his observations related to the growth of plants, the formation of the bark and the wood, the effects of grafting, the inversion of a tree, the double motion of the sap, and the influence of light, air, and soil. In agriculture he introduced the practice of drying corn in a particular stove or kiln, with a heat sufficient to destroy the insects which infested it and their larvas. He made many experiments on manures, and he conferred a great benefit on several provinces of France, by introducing the cultivation of potatoes into general practice, as well as by promoting that of rhubarb in different places.

Having obtained from M. Maurepas the appointment of inspector-general of the marine, he undertook to make himself master of every department of nautical knowledge; and setting out with the established doctrines of Euler and Bouguer, where theory was wanted, he collected for his works on these subjects an immense mass of facts and experiments, affording the means of resolving every question on practical grounds. He established a school for ship-builders, which effectually secured to them an education superior to that of simple carpenters. He also

Duhamel. made some very valuable improvements in the theory of rope-making, showing especially the disadvantages arising from the excessive twisting of cordage. His conduct in this capacity seems to have been as judicious in a moral as in a mechanical point of view; whilst by his modesty and good nature he silenced the contending passions of those with whom he was obliged to enter into discussion, and was enabled to unite a variety of opposite interests, in the important object of the establishment of an academy for the cultivation of naval science.

His meteorological observations included, besides the usual registers, accounts of the direction of the magnetic needle, of the state of agriculture, of the diseases of the year, and of the times of migration of birds, and of the appearance of their young.

From his experiments on the growth of their bones, he inferred that they are enlarged by means of the ossification of the laminae of the periosteum, nearly in the same manner as trees are known to grow by the hardening of the cortical layers; although the bones, while they are soft, expand in every direction, as the very young shoots of vegetables are also found to do. Having learned from Sir Hans Sloane that madder possesses the property of giving colour to the bones, he fed animals successively on food mixed and not mixed with madder; and he found that their bones in general exhibited concentric strata of red and white, whilst the softer parts showed in the mean time signs of having been progressively extended. These experiments are still of great importance in illustrating the physiology of ossification, although the actual conversion of the periosteum into bone may justly be disputed.

In trees Mr Duhamel found that the graft was incorporated with the stock, so as to form a single substance completely identical with it; and he showed that animal bodies were capable of a similar union, the vessels of the animals forming communications with those of the parts inserted; the spur of a cock, for instance, grafted into his comb, uniting perfectly with it, and becoming gradually furnished with a bony core, like the horn of a bullock, which either forms a joint with the cranium, or is firmly attached to it, and affords nourishment for the growth of this newly adopted member.

Having demonstrated in 1737 the different natures of soda and potass, he made an interesting experiment on the production of these alkalies by different vegetables. He sowed the head of the salsola kali at Denainvilliers, and it was found by the analysis of Mr Cadet that its ashes produced at first soda, but afterwards more and more potass every year; and after several generations almost entirely potass. His other chemical memoirs were of less permanent importance; and, with respect to the weight of ignited iron, he was unfortunately inaccurate in his mode of conducting the experiment, otherwise it must necessarily have led him to an anticipation of some of the most important discoveries of the last century.

From his extensive correspondence in different countries, he was enabled to communicate to the academy from time to time a number of detached facts, which were both amusing and instructive, and which appear perpetually in the histories of the respective years. His works were in general of an elementary nature, and calculated for the use of such as possessed but little previous information; and hence they may appear to some readers to contain an unnecessary detail of explanation. "Prolixity," says Mr Condorcet, "is injurious to perspicuity, when we are addressing ourselves to persons accustomed to fix their attention firmly on the subject before them, who are able to observe the slightest shades of difference, and to receive at once a variety of ideas; supplying, where there is occasion, any connecting links of the chain which may

have been omitted. If we are too diffuse, the attention of such persons droops for want of excitement; their memory is fatigued with the attempt to retain impressions which have not been communicated to them with sufficient force; and when they are compelled to travel slowly, the delay exhausts them, from having been in the constant habit of a more rapid motion. But it was not for this very limited class of readers that Mr Duhamel's works were calculated. He wrote for the use of those who seldom go beyond the bare expressions of the author, who find all close attention toilsome, and who read rather for simple information than for the cultivation of the mind; and an author may always be said to write well when his style is appropriate to his subject, and to the capacity of his readers."

Mr Duhamel was economical in his habits of life, and disinterested in his views, sacrificing his own pecuniary advantage, and that of his family, to the desire of serving the public by his experiments and his writings. Having once established a certain scale for his expenses, he never troubled himself with keeping a minute account of them. His integrity sometimes wore the appearance of severity, and his vivacity that of harshness; but no imputation was ever cast on the goodness of his heart. He was averse to all changes, both in political and scientific institutions, which were not connected with obvious improvement. He was punctual in his attention to the duties which his religion imposed on him, but he did not sacrifice to unnecessary parade such of his hours as he thought might be more conscientiously employed in studies of general utility. His application, though assiduous, was seldom severely laborious. He never entered into any matrimonial engagements. On some occasions he felt himself neglected by the public; but he was little disposed to lament this injustice, except from reflecting on the effect which it would have had on an individual less zealous or less independent than himself. Besides his election as a fellow of the Royal Society of London, he obtained the honour of diplomas from the academies of St Petersburg, Palermo, Bologna, Edinburgh, and Padua, and from several agricultural societies; and his name has acquired a celebrity commensurate to the extent of his varied researches.

Few persons have ever passed through life with greater tranquillity of mind, or with a greater desire of rendering themselves useful to mankind, than Mr Duhamel. He was one of the most active promoters of the kind of revolution which took place in the cultivation of science during the last century, and of which the characteristic distinction was, to endeavour to turn its chief course towards the grand objects of public utility and domestic convenience. Upon this modification of the pursuits of natural philosophy, Mr Condorcet very judiciously remarks, that "if the sciences have sometimes raised themselves too high towards heaven, and if it has been of advantage to recall them towards the earth, we must still shun the opposite error of condemning them to creep on it for ever." And when we see the paths of discovery open before us, we must follow boldly wherever they lead us, confident that, sooner or later, all theoretical knowledge may eventually confer some material benefit on society, even with regard to the more practical purposes of life. Mr Duhamel indeed well knew the necessity of previous study and of extensive inquiry for the success of his experimental investigations; and the former half of a long life he spent chiefly in qualifying himself for making the observations which he recorded, and deriving from them the instructions which he published, in the latter. At a very advanced age his memory began to fail; he still continued his pursuits, but without reaping any advantage

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from his application; he attended the meetings of the academy, but took little or no interest in any thing that passed at them; and after having been present at one of these meetings, on the 22d of July 1782, he had an attack of apoplexy, which wholly deprived him of his remaining faculties, and on the 13th of August put an end to his life.

A few years before his death he had felt very severely the loss of his brother, who had lived constantly at Denainvilliers, and had assisted him in many of his agricultural researches and meteorological observations, though he had always remained anonymous. His nephew, Mr Fougereux, had also been useful to him on several occasions in his literary pursuits; and this gentleman became heir to the principal part of the property of both his uncles. *Eloge*, by Condorcet, *Hist. Ac. Par.* 1782, p. 131. (L. L.)

DUILLIUS NEPOS, C., a Roman consul, the first who obtained a victory over the naval power of Carthage, in the year of Rome 492. He captured fifty of the enemy's ships, and was honoured with a naval triumph, the first of the kind ever granted at Rome. The senate rewarded his valour by permitting him to have music playing and torches lighted at the public expense every day while he was at supper. Some medals were struck in commemoration of his victory; and there exists a column at Rome which was erected on the occasion.

DUISBURG, a city of the Prussian province of Westphalia, on the river Ruhr. It is an active manufacturing place, and carries on a regular trade by weekly passage vessels with Arnheim, Dort, and other places in Holland. There was formerly a university here, which is now reduced to a gymnasium. In 1817 it contained 4510 inhabitants, but their number has since increased.

DUKE (*Dux*), a sovereign prince, without the title or quality of king. The word is borrowed from the Latin through the medium of the modern Greek. Some sovereigns have the title of *grand duke*, as the Grand Duke of Tuscany and the Grand Duke of Muscovy. The title of grand duke belongs to the heir apparent of Russia; and the title of archduke is given to all the sons of the house of Austria, and that of archduchess to all the daughters.

DUKE is also a title of honour or nobility, the next below princes.

The dukedom, or dignity of duke, is a Roman dignity, so denominated *a ducendo*, from leading or commanding. Accordingly the first dukes, *duces*, were the *ductores exercituum*, leaders or commanders of armies. Under the later emperors, the governors of provinces in time of war were entitled *duces*. In after times the same denomination was also given to the governors of provinces in time of peace. The first governor under the name of *duke* was a duke of the Marchia Rhætica, or Grisons, of which mention is made in Cassiodorus; and there were afterwards thirteen dukes in the eastern empire, and twelve in the western. The Goths and Vandals, upon their overrunning the provinces of the western empire, abolished the Roman dignities wherever they settled; but the Franks, in order to humour the Gauls, who had long been used to that form of government, made it a point of policy not to make any change therein; and accordingly they divided all Gaul into duchies and counties, giving to the governors of these sometimes the names of dukes, and sometimes that of counts, or *comites*.

In England, during the Saxon times, Camden observes, the officers and commanders of armies were called dukes, *duces*, in the ancient Roman manner, without any addition. But after the conqueror came in, the title lay dormant till the reign of Edward III., who created his son Edward, called the Black Prince, first duke of Cornwall;

a title which has ever since been the peculiar inheritance of the king's eldest son during the lifetime of his father, so that he is *dux natus, non creatus*. After this more dukes were made, in such a manner that their titles descended to their posterity. They were created with much solemnity, *per cincturam gladii, cappæque, et circuli aurei in capite impositionem*. In the reign of Queen Elizabeth, however, that is, in 1572, the whole order became utterly extinct; but it was revived about fifty years afterwards by her successor, in the person of George Villiers, duke of Buckingham.

Though the French retained the names and forms of the ducal government, yet under their second race of kings there was scarcely any such dignity as that of duke. All the great lords were called *counts*, *peers*, or *barons*, excepting, however, the Dukes of Burgundy and Aquitain, and the Duke of France, which was a dignity held by Hugh Capet himself, and corresponded to the modern dignity of *maire de palais*, or the king's lieutenant. By the weakness of the kings, the dukes or governors sometimes made themselves sovereigns of the provinces entrusted to their administration. This change happened chiefly about the time of Hugh Capet, when the great lords began to dismember the kingdom; so that this prince found more competitors among them than subjects. It was even with great difficulty that they could be brought to own him as their superior, or to consent to hold of him by faith and homage. What with force, and what by marriages, these provinces, both duchies and counties, which had been severed from the crown, were again gradually united to it. But the title of duke was no longer given to the governors of provinces. From that time duke became a mere title of dignity, annexed to a person and his heirs male, without giving him any domain, territory, or jurisdiction over the place of which he was duke. All the advantages of the title now consist in the name, and in the precedence which it gives.

The dukes of our days retain nothing of their ancient splendour except the coronet on their escutcheon, which is the only mark of their departed sovereignty. They are created by patent, cincture of the sword, mantle of state, imposition of a cap and coronet of gold on the head, and a verge or rod of gold in their hand.

The eldest sons of dukes are by the courtesy of England styled *marquises*, though they are usually distinguished by their father's second title, whether it be that of *marquis* or *earl*; and the younger sons are *lords*, with the addition of their Christian name, as Lord James, Lord Thomas, Lord Charles, and they take place of viscounts, though not so privileged by the laws of the land.

DUKE-Duke, a quality given in Spain to a grandee of the house of Sylva, on account of his having several duchies from the union of two considerable houses in his person. Don Roderigo de Sylva, eldest son of Don Ruy Gomez de Sylva, and heir of his duchies and principalities, having married the eldest daughter of the Duke de l'Infantado, the Duke de Pastrana, who was descended from her, added to his other great titles that of duke-duke, to distinguish himself from the other dukes, some of whom might enjoy several duchies, but none so considerable ones.

DUKLA, a city in the circle of Jaslow, of the Austrian kingdom or province of Galicia. It stands on the river Jasielka, on the great road to Hungary, in a fertile district, in which are manufactories for cloth, flannels, and baizes.

DULVERTON, a market-town in the hundred of Willerton and Freemanners, in the county of Somerset, 168 miles from London. The town is well built, and clean, having two streams of water running through it. It was formerly a manufacturing town for coarse woollen goods, but the trade has greatly declined. The market is held on Satur-

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Dumarsais day. The inhabitants amounted in 1801 to 1049, in 1811 to 1035, in 1821 to 1127, and in 1831 to 1285.

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DUMARSAIS, CESAR CHESNAU, a French writer, who distinguished himself as a philosophical grammarian, was born at Marseilles on the 7th of July 1676. His life consisted of a succession of misfortunes; and his merits, considerable as they were, seem to have been entirely overlooked and neglected by his contemporaries. His father died while he was yet an infant; and his mother, by her extravagance, dissipated his patrimony. He was educated in his native town by the Fathers of the Oratory, into whose congregation he entered, but left them at the age of twenty-five, and repaired to Paris, where he married, and was admitted an advocate in 1704. He soon, however, quitted the bar; separated from his wife, to whom he gave up the little he possessed, and went to reside with the President de Maisons, in the capacity of tutor to his son. But his prospects in this quarter were blasted by the death of his patron, by whose family he was not treated with that respect and gratitude which were due to his talents and his services. He was afterwards successively tutor to the son of Law, the famous projector, and of the Marquis de Beaufremont. It was during this last period that he published the results of his grammatical investigations, which were received with great coldness. At a subsequent period he opened an establishment for education in the suburb St Victor, which scarcely afforded him the means of subsistence; and he expired, at length, under the accumulated pressure of years, infirmities, poverty, and neglect, on the 11th of June 1756, at the age of eighty.

Dumarsais possessed no ordinary talents. His researches are distinguished alike by their accuracy, ingenuity, and depth. As a man, he combined the greatest purity of morals and simplicity of character with a rare degree of manly fortitude in the midst of his misfortunes; yet during the greater part of his life he was left to languish in obscurity, and his merits scarcely attracted any notice until nearly half a century after his death. His works on philosophy and general grammar, however, are worthy of attention. Of these, the best is his *Treatise on Tropes or Figures*. D'Alembert and Voltaire have both paid a just and discriminating tribute to the merits of Dumarsais. An edition of his works was collected by Duchosal and Millon, and published at Paris in 1797, in seven vols. 8vo.

In the year 1804, the French Institute proposed a prize for an *Eloge* on Dumarsais, which was gained by M. Deжерando, whose work was published at Paris, 1805, in 8vo. A previous and well-written *Eloge* on the same author, by D'Alembert, is to be found in the *Mélanges de Littérature*, and prefixed to the above-mentioned edition of the *Works of Dumarsais*. See also *Biographie Universelle*.

DUMBARTON, a county in Scotland, situated between 55. 53. and 56. 25. north latitude, and between 3. 55. and 4. 53. west longitude from Greenwich, consists of two districts, six miles distant from each other, part of Lanarkshire running between them. The western, which is much the larger, is about forty miles long and twelve broad, and is bounded by Perthshire on the north; by Argyleshire, from which it is separated by an arm of the sea called Loch Long, on the west; by the river Clyde and Lanarkshire on the south-west and south; and by Stirlingshire on the east. The eastern district is completely enclosed by Stirlingshire and Lanarkshire. The whole county contains 298 square miles, or 190,848 English acres, of which the smaller division contains about forty-two miles, or 28,000 acres. It is divided into twelve parishes, of which there are only two in the eastern district, Kirkintilloch and Cumbernauld. This last belonged to Stirlingshire, till the Earl of Wigton, whose property it was,

became heritable sheriff of Dumbartonshire, when he procured it to be annexed to this county.

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The prevailing winds are from the west and south-west, but easterly winds are frequent in the spring months. Showers are very common, but heavy and continued rains of rare occurrence. Frosts are seldom severe, and, except on the mountains, snow never lies long. The climate is upon the whole salubrious. The range of the barometer is about 28.0, and of the thermometer from 6° to 80°. The soils of the lower grounds are schistose clay mixed with small stones, rich black loam on the banks of the Clyde, and gravelly soil on the river Leven; but about two thirds of the county consist of lofty mountains, some of them 3000 feet high, part of the ridge which crosses the island from Forfarshire to the Frith of Clyde, known in the districts to the eastward by the names of the Siedlaw, Ochil, and Campsie Hills.

Coal, iron ore, limestone, freestone, and slate, are its most valuable fossil productions. There are pits for working coals at Langfauld and Lawmuir in East Kilpatrick, and at Duntocher in West Kilpatrick, where great quantities are raised for the consumption of the cotton works at Duntocher, and for calcining lime at the neighbouring lime works. Ironstone is raised in considerable quantities in the parishes of Kirkintilloch and Cumbernauld, which meets with a ready market at Carron foundery.

Limestone is found in the higher grounds at Kilpatrick, Dumbar-ton, and Row; but it is only wrought at Langfauld, Lawmuir, and Duntocher, where coal is quarried along with it, and also at Row, Netherwood, and Cumbernauld. White and red freestone are met with in several places; the finest quarries are at Garscube, on the banks of the Forth and Clyde Canal; and at Levensgrove and Dalreoch, in the immediate neighbourhood of Dumbar-ton.

Several slate quarries have been wrought with success, at Luss and Camstradden on the estates of Sir James Colquhoun, and at Roseneath on the estates of the Duke of Argyll. The principal markets are at Glasgow, Greenock, &c. to which the slates are conveyed in lighters by the Leven and the Clyde.

The only river of any note which can be said to belong to this county is the Leven, the outlet of Lochlomond, which, flowing for about five miles through a fine valley, joins the Clyde at Dumbar-ton Castle. Its waters, which are singularly pure and soft, are well adapted to the business of bleaching and printing cottons, branches which are established to a great extent along its course. The other streams are Luss, Froon, Finlays, Douglas, Falloch, and Luggie. Clyde, Endrick, and Kelvin, flow along its borders. Lochlong and Gareloch are arms of the sea, the first of which separates this county from Argyleshire; and the other, penetrating the land for about seven miles, nearly detaches the peninsula of Roseneath from the mainland. Whilst this extent of sea-coast affords the benefit of water carriage to so large a portion of the county, the inland tracts are benefited in almost an equal degree by the Forth and Clyde Canal, which passes through it for more than sixteen miles. This canal is about thirty-five miles in length, and it rises and falls about 160 feet, by means of forty locks. It is carried over the valley where the Kelvin flows, by an aqueduct sixty-five feet in height and 420 feet in length. The only remarkable lake is Lochlomond, which is about twenty-four miles long, and in its greatest breadth, towards the south, above six. About two thirds of the shore, and most of its islands, thirty in all, are in Dumbar-tonshire; the rest belong to Stirlingshire. It is probably not to be equalled by any lake in Britain for the variety and magnificence of its scenery; the picturesque beauty of its wooded banks and islands affording a striking contrast to the rugged and lofty moun-

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tains that rise in its vicinity. It covers about 20,000 acres, and its surface is supposed to be increasing. The best view of the lake is from a promontory above Luss, a village on the western shore.

The landed property of this county is divided among about a hundred and fifty individuals, exclusive of feuars in towns and villages. One third of the estates are of considerable extent, and the remainder are small. The valued rent is L.33,327. 19s. Scots, of which about a third is held under the fetters of strict entails. In 1811 the actual rent of the lands was L.56,972. 15s., and of the houses L.5791. 15s., total L.62,764. 10s.; and the annual value of real property in 1815 was L.71,587 sterling. There are a number of beautiful seats belonging to the larger proprietors, among which Roseneath, the splendid mansion of the Duke of Argyll, and Garscube, the residence of Sir Archibald Campbell of Succoth, are by far the finest specimens of architecture. There are also a great many fine villas, the property of manufacturers and merchants.

The county sends one member to parliament, who, prior to the passing of the reform act in 1832, was elected by about seventy voters upon superiorities; but by the reform measure the constituency has been increased to 924.

The arable lands of Dumbartonshire are divided into farms ranging in extent from 50 to 250 acres: and of late years great improvements have been made in agriculture, and in the breed of all kinds of stock. The land is generally laboured and manured according to the improved system of husbandry; two crops of grain seldom or never being taken without the intervention of a green crop properly tilled and manured. The usual rotation is, first, oats; secondly, potatoes or other green crop; thirdly, wheat or barley sown with rye-grass and clover; fourthly, hay; and, lastly, pasture. Wheat, oats, and potatoes, are the principal crops. The land is well inclosed and subdivided, principally by hedge and ditch, and partially by stone-walls. The tenants generally hold leases for nineteen years. Within the last twelve or fifteen years the breed of draught or farm horses has been greatly improved; a circumstance which is ascribed partly to the emulation excited among the tenantry to ride good horses at the yeomanry drills, and partly to the annual competition for prizes given by the landlords of this district. The dairy stock is principally of the Ayrshire breed; and great improvements have also been made in this department, which is a source of much profit to the farmers nearest to the city of Glasgow. The accommodation to the tenantry has kept pace with these improvements. Many excellent steadings have been erected, generally in the form of a square, having in front the dwelling-house, which communicates with the offices, forming the other three sides of a square.

There are in this county many excellent tracts of pasture land. Sheep of the black-faced breed, and a limited number of black cattle, are reared with great success. The sheep are disposed of in Glasgow, where there is a weekly sale; and the cattle are sold at the Carman market, held in the Moor of Carman on the first Tuesday of June. From 12,000 to 17,000 head of cattle, principally of the Argyleshire breed, are generally disposed of at that market, for the purpose of being fattened on the rich pastures of the south. In the highland district, farms for grazing are necessarily of great extent. But it is not uncommon for fishermen and mechanics to hold pendicles, or "poffles" as they are called, below L.12 of rent; and the cottars, who are usually employed as labourers on the larger farms, possess small patches of arable ground for raising potatoes, with hill pasture for a cow, at a rent of L.5, and sometimes less.

Great improvements have been made on the roads intersecting this county. A new road along the upper part

of Lochlomond, and passing through Glenfalloch, communicates with the great military road through Perthshire, Argyleshire, &c. and renders all parts of this county of easy access.

The woods and plantations of this county are extensive and valuable. According to the agricultural survey in 1810, their extent appears to be near 7000 English acres, of which about the half is coppice; yielding to the proprietors a yearly income almost equal to the rent of the arable lands. On spots unfavourable to oak, these coppice woods consist of ash, yew, holly, mountain-ash, birch, hazel, aspen, alder, crab, thorn, and willow. The age at which they are cut is from twenty-two to twenty-four years, when they are worth from L.40 to L.45 an acre; but there are instances of woods, of considerable extent, selling at much more, where proper attention has been paid to inclosing them, and afterwards thickening them by means of layers, or thinning them, as may be necessary. It is the usual practice to reserve a certain number of young trees at each cutting, the greater part of which are cut down at the second fall, when they are nearly fifty years old, and the rest left to grow up to timber trees. The soil and climate of this county are particularly favourable to plantations, which begin to make a return to their owner in ten or twelve years, and in thirty years afford supplies to the carpenter. The most extensive plantations are on the estates of Luss and Bonhill. There is a very fine ash in Bonhill church-yard, the branches of which cover an area one hundred feet in diameter. Its trunk is about nine feet high, the smallest diameter is six feet, and its three principal branches are from ten to twelve feet in circumference. On the banks and islands of Lochlomond there is a considerable number of yew trees, some of them of great size.

The manufactures of this county are various and extensive. The cotton works at Duntocher, belonging to Mr Dunn of Duntocher, are the most extensive works of that description in Scotland. He gives employment to a population of 2500, and he is the second landed proprietor in the county. There are two paper-mills at Dalmuir; two extensive ship-building yards, three large glass manufactories, and two tan-works, at Dumbar-ton; a manufacture of alkali at Burnfoot of Dalmuir; and a distillery of pyroligneous acid at Milburn. On the short course of the river Leven, not much exceeding three miles in a direct line, there are twelve large print-fields and bleach-fields. The extent of the whole, in 1810, is thus stated:

Ground occupied, about (Scotch acres).....	350
Value of buildings and machinery.....	L.250,000
Coals consumed annually, tons.....	32,000
Yearly expense in fuel.....	L.19,000
Number of persons employed, of both sexes and	
all ages.....	3,000
Average earnings about 2s. a day.	
Total yearly wages, allowing for interruptions	
from sickness and other causes.....	L.90,000
Excise duties annually.....	L.140,000

Besides these large establishments, there is a number of lint-mills, two woollen-mills, chiefly employed in carding, and several fulling-mills.

The gross produce of the salmon-fisheries of this county may be about L.1000 a year; the principal are upon the rivers Leven and Clyde. Those on Lochlomond are comparatively of little importance. About fifty boats are employed in the herring fishery, of which the annual value may be about L.4500.

The rates of wages are higher in this than in most of the Scottish counties. In 1810, farm servants, who are for the most part unmarried, had from L.35 to L.42 a year; and when manufactures are prosperous, many of the work-

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men in them earn nearly twice as much. Provisions are also dear; and fuel, which consists principally of coal, the greater part of it brought from the adjoining counties, is in many parts higher priced than in our largest cities. There were about 274 paupers in the county in 1811; but few of them were maintained solely on parochial charity. Such as are able to gain their subsistence in part by their own industry, receive only what is necessary to support them in addition to their own earnings; and those

who are altogether incapable of work are in most cases relieved by the charity of individuals, the parish paying only for clothes and house rent. The whole sum expended by the parishes does not much exceed L.1000 a year, of which a small part is raised by assessment. The rent of land and interest of capital amount to L.200, incidental funds to L.120, and the collections at the churches to L.390.

The following is a tabular view of the population of this county:—

	1801.	1811.	1821.	1831.
Arrochar parish.....	470	420	376	559
Bonhill ditto.....	2,460	2,791	3,003	3,874
Cardross ditto.....	2,549	2,859	3,105	3,596
Cumbernauld ditto.....	1,795	2,334	2,864	3,080
Dumbarton burgh and parish.....	2,541	3,121	3,481	3,623
Kilmarnock parish.....	879	898	1,008	999
Kilpatrick, New or East, parish.....	1,404	1,643	1,545	1,675
Kilpatrick, Old or West, parish.....	2,844	3,428	3,692	5,879
Kirkintilloch parish.....	3,210	3,740	4,580	5,888
Luss ditto.....	953	965	1,150	1,181
Roseneath ditto.....	632	747	754	825
Row ditto.....	970	1,243	1,759	2,032
County of Dumbarton.....	20,710	24,189	27,317	33,200

DUMBARTON, the capital of Dumbartonshire, in Scotland, is situated at the confluence of the rivers Clyde and Leven. It is a very ancient place, and is said to have been once the capital of a kingdom of the Britons, established in the vale of the Clyde. Alcluyd was the name of this ancient capital of the Strathclydenses; but whether it was situated on the site of the present town, or confined within the precincts of the castle, cannot be exactly ascertained. Dumbarton is built upon the eastern bank of the Leven, which almost encircles it. The greater part of the town is composed of one main street, lying in a semicircular form round the head or west end of the peninsula. At the height of the tides it is flooded by the waters of the Leven. It was erected into a royal burgh by Alexander II. in the year 1221, and declared to be free of all imposts and burgh taxes; it afterwards received other charters from succeeding monarchs; and, finally, it obtained a confirmation of the whole from James VI. The subsequent history of the burgh is destitute of interest. It naturally partook of the fortunes and misfortunes of the adjacent part, of which it was in reality a dependency. Besides the main street, there are some bye thoroughfares, lanes, and detached houses, and a suburb on the western side of the Leven, leading to Renton. It is connected with the latter by a good stone bridge of five arches, 300 feet long. The waters of the Leven form a commodious harbour, and, for the benefit of trade, an excellent quay and capacious dock have been formed. Ship-building is carried on to some extent. The principal article of manufacture and export is glass. The glass-works, which are situated to the north-west of the town, give employment to a great number of individuals; and the article made is considered as equal to any manufactured in Britain. The other and inferior manufactures of Dumbarton are leather, glue, some linen, beer, &c. with a considerable quantity of goods for the Glasgow market. In recent years the intercourse and trade with Glasgow have been much extended by means of steam navigation. Dumbarton has an important cattle market every year on the 4th of June. There are two other fairs throughout the year, and the town has a large weekly market on Tuesdays. The burghal government of the town consists of a provost, an elder and younger bai-

lie, a dean of guild, a treasurer, five merchant councillors, and five trades councillors from the same number of incorporated trades. The town has an excellent grammar-school, and a good subscription library. A branch of the Commercial Bank is settled here, and there are a number of agents of insurance offices. A very excellent jail has recently been erected. The church of the burgh and parish is a handsome modern structure with a spire and clock. There are also in the town and its vicinity a burgher and relief meeting house, and a Roman Catholic chapel. The town is the seat of a presbytery in the synod of Glasgow. By the late reform act Dumbarton joins with Kilmarnock, Rutherglen, Renfrew, and Port Glasgow in returning a member to parliament. The situation of Dumbarton Castle is eminently picturesque. The buildings composing the fort are perched on the summit of a rocky mount, shooting up to the height of 206 feet sheer out of the alluvial plain on the east side of the debouche of the river Leven. To the west of the castle there are rocky eminences on the verge of the Clyde, of a similar fabric, though less detached. The rock of Dumbarton measures a mile in circumference at the base. It diminishes in breadth near the top, which is cloven into two summits, of different heights. The rock is basalt, and has a tendency to the columnar formation. Some parts of it have a magnetic quality. The fortress, naturally strong, possesses several batteries, which command a most extensive range. The defences are kept in constant repair, and it is garrisoned by a limited body of soldiers and functionaries. The rock of Dumbarton has been occupied by works of a warlike character during the successive dynasties of 1800 years, and, as such, it is the most ancient stronghold in the country of which any record or tradition is preserved; nor is it necessary to observe, that it was the scene of many a gallant exploit to be found recorded in the annals of the country. Dumbarton is fifteen miles north-west of Glasgow, and fifty-nine west of Edinburgh. The population of the burgh and parish amounted in 1821 to 3481, and in 1831 to 3623.

DUMBLANE, a town of Scotland, in the south-western portion of Perthshire. It is delightfully situated on the eastern bank of the river Allan, at the distance of forty-

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Dumbness one miles from Edinburgh. In the middle ages this place was distinguished as being the seat of a convent of Cul-dees, and continued to be so till about the twelfth century. **Dumfries.** **Dumblane** was constituted the seat of a bishop by David I. Amongst those who, subsequently to the reformation, filled the chair, was the celebrated philanthropist Robert Leighton, who bequeathed his valuable library to the cathedral and diocese. It is still in existence, and has been augmented by several donations. Dumblane is at present only a village, consisting of a single street of an old-fashioned character, with various diverging lanes. A mineral well in the neighbourhood causes an influx of visitors during the summer months. The chief attraction of Dumblane is what was once the cathedral of the bishop, the choir of which is now the parish church. It is a large Gothic edifice, with a steeple of modern erection of 128 feet in height. Besides the parish church, there is a dissenting meeting-house. There is here a weekly market, and there are also four annual fairs. The population of the town and parish amounted in 1821 to 3135, and in 1831 to 3228.

DUMBNES, the privation of speech. See **DEAF AND DUMB**.

DUMBOWITSKA, a circle in the western part of Wallachia, between the rivers Ardfisch and Aluta. It is watered by the streams of the Ardfisch, Jalomitza, and Dumbowitska, and contains one city, Tergovst, and 164 villages.

DUMFRIES, a county in the south of Scotland, is situated between 55. 2. and 55. 31. north latitude, and 3. 53. west longitude. Its greatest length is nearly sixty miles, and its greatest breadth from thirty to thirty-one. The boundaries are Galloway and part of Ayrshire on the south-west; Roxburgh, Selkirk, and Peebles, on the north-east; Lanark on the north-west; and on the south-east the Solway Frith and the county of Cumberland. The principal rivers are the Nith, the Annan, and the Esk, all of which discharge themselves into the Solway Frith. These rivers are fed by numerous tributaries, and the whole of them abound in salmon. The square miles of the county are calculated at 1006, and the acres at 644,385. Like many other Scottish counties, Dumfriesshire is popularly divided into districts. Of these there are three principal; Eskdale on the east, Annandale in the middle, and Nithsdale on the west, each taking its name from the river which traverses it. From these larger divisions diverge smaller vales, which likewise derive their titles from the streams that flow through them, such as Moffatdale, Dryfesdale, and Ewesdale. From various circumstances, the limits of these great divisions are but imperfectly defined, and have recently been abandoned. The Solway Frith waters the base of the county for twenty-four miles, and along its margin the land is generally flat for about ten miles. Beyond this the county expands into a series of hills and valleys, which rise gradually northward till they reach the mountain chain which bounds it in that quarter. The principal elevations are, Lowthers near Wanlockhead, which rises 3150 feet, and Hartfell in Annandale, which rises 2629 feet above the level of the sea. In former times it was said that 86 miles were in general low arable land, lying on the sea-coast, 322 miles chiefly hilly, and 598 mountainous. But the calculation has been disturbed by the steady progress of bone manure and green crop husbandry. Steeps which it was impossible to sharpen by common manure, from the expense and difficulty of transporting it thither, have been brought into excellent heart by ground bones, and improved by at least a hundred per cent. both as crop and pasture land. Many hills which were nearly bare have been covered to their tops with thriving plantations. In the spring of 1833 the Duke

of Buccleuch inclosed and planted nearly three hundred acres, on which are now growing more than a million and a half of trees; and it is his grace's intention to prosecute these improvements a great way further. Still a large proportion of the county is mountainous, and is devoted almost exclusively to sheep farming, which, since the mortality of 1829, has again become very profitable. Judging from the map, nearly a third of the land in the county belongs to the nobleman above mentioned, who possesses a rental of one hundred and fifty thousand pounds yearly, two thirds of which are drawn from Dumfriesshire. In 1811, when the property-tax pressed on the energies of the country, the whole rental of the county was estimated at L.246,001. 12s. 6d.; and although rents have fallen greatly since that period, so marked has been the progress of improvement, that at present (1833) it in all probability exceeds L.300,000 sterling. The principal proprietors are the Duke of Buccleuch, the Marquis of Queensberry, and the Earl of Mansfield; Mr Hope Johnstone of Annandale, General Sharpe of Hoddam, Mr Rogerson of Dumcrieff, Mr Menteth of Closeburn, and Mr M'Alpine Leny of Dalswinton.

The climate of Dumfriesshire is mild and salubrious; much of the land has a southern exposure, and, excepting in very severe winters, the snow speedily disappears. The soils are gravel or sand loam, and clay, with moor and moss in some places, particularly along the bed of the Lochar, with alluvial tracts on the banks of the rivers and the Solway Frith. The farms vary greatly in size; but for years there has been a tendency to uproot almost entirely the pendicle system. On the Buccleuch estates the farms are generally extensive. Many excellent steadings of houses have been built, and subdivisions formed over waste tracts, which for centuries remained uninclosed. Since the war the wages of rural labour have been pretty stationary. The usual rate of wages for a ploughman is six pounds per half year, with board and lodging in the case of unmarried men, and a proportionate allowance of meal, potato-land, &c. for hinds with families. House and dairy-maids receive from L.2 to L.2. 10s. per half year; day labourers 1s. 2d. a day in winter, and 1s. 6d. in summer.

At one time the quantity of lime used, or at least worked, in Dumfriesshire, was very great, and it is still far from being inconsiderable. The principal pits are those of Kilhead, Closeburn, and Barjarg; and within the last fifteen years the supply was estimated at 1,200,000 Winchester bushels, valued at L.54,000. The capabilities of the pits are still excellent, but the demand for lime has diminished somewhat, owing to the continued progress of bone dust, a manure which unites to a certain extent the qualities of lime and common dung. Annandale and Nithsdale have profited greatly by this valuable mineral. Mr Menteth of Closeburn is a great land improver, and has converted bogs which were hardly worth five shillings an acre into some of the finest pasture land in the county, by the combined effects of pairing, careful selection of seed, the application of lime, and irrigation. Cattle and sheep are bought at the Falkirk trysts, and fattened during winter and the early part of spring. The latter branch of traffic is yearly extending. The indigenous breed of cattle is still the Galloway, although not always pure and unmixed. Of heavy or drove cattle, about 20,000 head are driven south annually, and their value in good years amounts to nearly L.200,000. Of the sheep fattened no census has yet been given, from the circumstance that they are mostly conveyed in steam-boats. Mutton has risen in price in the home markets; and there can be no doubt that steam navigation is rapidly equalizing prices in town and country. The sheep are of three kinds; black-faced, Cheviots, and half-breds, the latter being a cross between the Leicester and the

Dumfries. Cheviot. Until 1820, hardly a single half-bred appeared at Lockerby Hill; now, however, they are quite common, and appear to be gaining as fast on the Cheviots as the latter are gaining on the black-faced. Pig husbandry is much cultivated in Dumfries-shire and Galloway; and a large proportion of the hogs reared in the stewartry are sold in Dumfries, and cured in Annandale and Cumberland. The curing trade lasts for about three months, commencing in December and ending in February. The sales are all paid in ready money, and instances have occurred in which green pork to the amount of L.6000 has been sold before breakfast on a Wednesday morning. The curers have good and bad seasons; but the capital required induces caution, and it is a fact that bankruptcy is nearly unknown among the bacon traders of the district. The hams of Dumfriesshire are so much esteemed that they are frequently sold in London under the name of Westphalian. Those who farm pendicles trust mainly to their pigs when rent-day comes round; and the trade every year brings L.3000 into Johnstone, which is equal to the landed rental of the parish. Its annual value to the district, including the curer's profit, must be very nearly L.100,000 sterling.

The manufactures of the county are dressed leather, hosiery, clogs, and carpets. The cotton mill at Langholm has ceased to work, and such weavers as remain there are supplied with webs by the manufacturers of Carlisle. In Dumfries and other parts of the district the same class of persons derives employment from the city of Glasgow. The hosiery trade exceeds L.20,000 per annum, and that of dressed leather is probably double this amount. The carpet and spinning and dyeing manufactory at Cra- wick Mill, in the neighbourhood of Sanquhar, employs 150 persons, young and middle aged. It consumes nearly 5000 stones of wool, and produces 70,000 yards of carpeting yearly. The wages average from L.180 to L.200 monthly.

Although, as we have already remarked, Dumfriesshire is mountainous, its lakes are inferior to those of Galloway, both as to number and extent. We must make an exception, however, in favour of the Castle Loch of Lochmaben. Bruce's castle stood on a promontory on the farther side of the loch; but it is so much dilapidated that such artists as sketch it contrive to hide the nakedness of bare unashlared walls by the enlivening screen of green trees. In some of the lakes a singular fish is found, which naturalists term the vendace, and which is supposed to be peculiar to this place, if we except, perhaps, the lake of Geneva. At the "four towns of Hightae," in the neighbourhood, King Robert granted feus to a class of persons who were known as "the king's kindly tenants." Their possessions are small, but the land is rich, and they sit at almost a nominal rent. They are a peculiar race, who live in a little world of their own, and are beginning to feel the effects of continued isolation and intermarriage among the members of their own tribe. Loch Skene, about ten miles from Moffat, is the only other lake of consequence. It is 1300 feet above the level of the sea; the scenery around is stern and savage in a high degree; and its superfluous waters, in escaping to the strath or valley below, foam and leap from the dizzying heights above, and form the fine cascade called the *gray mare's tail*.

Considerable quantities of salmon are caught in the Nith, and in the stake-nets at Caerlaverock and Annan Water Foot. The finny tribes push into other streams, such as the Milk, the Esk, the Ewes, and the Wauchope; and in former times were speared in Moffat water. The supply of red fish is augmented by importations from Galloway.

The lower parts of Dumfriesshire consist of various varieties of sandstone, the layers of which generally dip to the Solway. There is a considerable body of limestone, as

we have already observed. Iron in different forms is also found in the strata. Marl abounds in various parts, and of freestone and whinstone there is abundance everywhere. Marble is also procured, and employed for some purposes; a little slate is likewise found. Coal in considerable quantities exists at the two extremities of the county, Sanquhar and Langholm; and, with one or two exceptions, all the pits belong to the Duke of Buccleuch. Lengthened land-carriage prevents the tacksmen from competing with the coal miners of England; and consequently the town of Dumfries and many parts of the county are supplied with fuel from Workington and Maryport. The trade employs a considerable amount of tonnage. The lead mines at Wanlockhead and Leadhills belong to the Duke of Buccleuch and the Earl of Hopetoun. Their capabilities at present are nearly equal, but both have declined greatly, from the importation of Spanish lead, the increased difficulty of working the shafts, and the poverty of the ore. For thirty years previously to 1828 each of the places mentioned produced about 700 tons of smelted lead annually; the price was L.23 per ton, and the gross revenue L.20,700. The Duke of Buccleuch and the Earl of Hopetoun received a sixth part each of the produce as rent, and netted respectively L.3450 per annum. Both have reduced the rent; the first to one twelfth, and the second to one eighth of the produce; and their incomes from this source have fallen to L.700 and L.1000 annually. Neither mine at present produces more than 650 tons of smelted lead annually, and the price has fallen to L.13 per ton. The consequences may be anticipated. Wanlockhead and Leadhills are no longer what they were, whether as regards the numbers, the comfort, or the intelligence of the mining population.

The mineral waters of Moffat are well known, but the spas in other parts of the county are too obscure to require special notice. The chalybeate at Hartfell acts as a powerful tonic, and contains, of sulphate of iron eighty-four grains, sulphate of alumina twelve, oxide of iron fifteen, and five inches of azotic gas, in a wine gallon. This spring was discovered about eighty years ago, but is too remote from the village to be of much use. The other spring, which is much more accessible, is strongest and best at the fountain-head, and probably the walk or ride (about a mile and a half) does as much good to invalids as the water. The Moffat Spa contains, muriate of soda thirty-six grains, sulphuretted hydrogen gas ten cubic inches, azotic gas four inches, carbonic acid gas five inches. More than two centuries have elapsed since this spring was discovered. A few years ago baths, with a pump and reading-room, were erected by subscription in Moffat, at an expense of L.2000; an immense improvement, which has greatly increased the annual number of visitors. Annan, Lockerby, and Langholm, are all thriving, well-built towns. The scenery of the latter place is much admired, particularly the ride along the banks of the Esk to Longtown.

The county sends one member to parliament, and the united burghs of Dumfries, Annan, Lochmaben, Sanquhar, and Kirkcudbright, a second. The population amounted in 1821 to 70,878, and in 1831 to 73,770, increase 2892.

DUMFRIES, the capital of the above county, is a royal burgh of considerable antiquity, although the period at which it became incorporated is not exactly known. During the border wars it was frequently stormed, and the public records were destroyed. The current belief, however, is, that it received its charter before the middle of the eleventh century, as a gravestone was discovered a number of years ago, bearing the date 1079, and mentioning that the individual whose ashes it covered had been conspicuous as a merchant and burgess of the town. From

Dumfries. this time it gradually increased in importance; and in the year 1307, Edward the Second appointed the estates of Scotland to assemble on the banks of the Nith. In certain chronicles the ancient name of the town is said to have been *Cotiac*, but this we suspect is mere fancy. It seems much more probable that, like many other places, it derived its name from its physical appearances and character. In remote times the Gaelic was spoken on both sides of the Frith of Forth; and we concur in the etymology of Mr George Chalmers, who conceives the word to be composed of *dun* a castle, and *fries* a ridge. *Dumfries*, which may be regarded as the capital of the south of Scotland, is beautifully situated on the left bank of the river Nith, thirty-five miles below its source, and upwards of ten above the point where its waters mingle with and are lost in the Solway. The Nith in point of size ranks fifth among the rivers of Scotland, and is navigable from Carsethorn to Glencaple quay, even for vessels of considerable burthen. In consequence of the extraordinary manner in which the tides ebb and flow in the Solway during the winter months, the river is similarly affected.

The origin of the town appears to have been owing to a strong castle, which flourished as a border fortress during the twelfth century, and frequently became an object of contention, both prior and subsequent to the times of Wallace and Bruce. Of this stronghold not a vestige remains; but the street occupying the ground on which it stood retains the name, and is likely to do so till the latest ages. In razing what remained of this place of strength, the local authorities, more than a century ago, found materials for building the new church. The Gray Friars, like the castle, attracted settlers; and, as early as the thirteenth century, the old bridge was planned and built at the expense of the Lady Devorgilla, third daughter of Alan, lord of Galloway, and grandmother to John Cumin, who was slain by Robert Bruce in the above-mentioned cathedral in the beginning of the year 1305. Originally it consisted of thirteen arches, and was guarded at the middle by a gate or port, which was removed in 1769, to lessen the central pressure when the structure became frail. This bridge, which still remains, and is crossed every day by foot passengers, was certainly a wonderful erection for the time; and, accordingly, the writer of a work entitled *A Journey through Scotland*, published by J. Pemberton, London, in 1723, says, "I passed the river Nith from Galloway to *Dumfries* over a fair stone bridge of thirteen arches, the finest I saw in Britain next to London and Rochester." A right of toll was attached to the bridge, which in 1789, according to Captain Grose, yielded a yearly rental of three hundred pounds, and which at the present day, a little higher up the river, produces to the town five hundred pounds sterling. The new bridge was commenced in 1793, and finished in 1795. The original contract price was L.4500, but as no rock could be found at one point, the landstool on the *Dumfries* side was founded on piles of wood, and for this the commissioners of supply allowed an additional sum of L.500.

After Bruce had committed the crime already mentioned, and commenced that career which terminated at last in the redemption of his country from a foreign yoke, he became a mark for the vengeance of Edward of England. His friends and adherents also suffered along with him. Amongst these, Sir Christopher Seaton was betrayed by a pretended friend of the name of Macnab, apprehended at the Castle of Lochore in Fifeshire, marched to *Dumfries*, and barbarously executed on the Gallows-Hill, a slight eminence on the north-eastern side of the town, better known by the name of the Christell Chapel. Bruce sincerely regretted his fate, and, in the words of Sir Richard Maitland of Lethington, said, "It is ane pity that sa noble

ane knight should die sa cruel ane dead.' And incontinent in the same place where he was standing when the tidings came to him, garred found a chapel in honour of the Virgin Mary; and, in remembrance of the said Sir Christell, founded a priest to devine service therein perpetually, and pray for the said Sir Christell; and gave to the said priest and his successors the sum of L.5 sterling, to be taken of the barony of Carlaverock, for their sustenance." The ruins of the Christell Chapel were visible in the beginning of 1715; but when the Jacobite rebellion broke out in Scotland, the inhabitants of *Dumfries* hastily constructed a rampart, and during the operation the ruins of the old chapel disappeared, the line of fortification having passed close by their site. It is evident, from the traces of the foundation, that the building must have been very small. When Lord Scroop made an excursion in 1570 for the purpose of plunder, the chief magistrate of *Dumfries*, at the head of the burgesses, joined Lord Maxwell in opposing the invaders. They fought gallantly, but were unfortunately defeated. *Dumfries* suffered considerably during the reigns of Charles the First and Second. In 1617 it was visited by James the Sixth whilst returning to England. It was at this period that the incorporated trades received from James what is called the "siller gun," which was ordered to be shot for at stated periods, with the view of fostering their martial spirit, and skill in the exercises performed at the wappinshaw. This relic is still in existence, and the custom is yet observed at the distance of seven or nine years, more as a holiday exercise than for any other purpose. The trades muster in great strength, borrow guns far and wide, spend three fourths of the day in shooting, return to an entertainment in their hall in the evening; and the "siller gun," after being won, is worn for a short period by the best marksman. This festival forms the subject of a poem, written by Mr John Mayne, and which is praised for its humour and spirit in the notes appended to the *Lady of the Lake*.

Almost no town in Scotland stood forward half so prominently as *Dumfries* did at the period of the union in 1707. On the 20th of November of the preceding year, according to Chalmers, two hundred Cameronians entered the burgh, issued a manifesto against the great pending measure, and burnt the articles at the market-cross. The last commotion of any consequence occurred in 1715, when the Viscount Kenmure hung on the heights of Tenwald, willing to do mischief, and yet timid as to the means and manner of attack. By a well-managed stratagem he was induced to depart; and this is believed to have been the last occasion on which the ancient war-cry of the town, "Lereburn," or "A Lereburn," was heard.

Dumfries is the seat of a presbytery, synod, sheriff's court, record of sasines, and four banks, branches of the principal companies of Scotland. There are two churches in connection with the establishment, an episcopalian, a catholic, and a number of other chapels supported by dissenters.

In 1745, the Pretender and his rebel army, whilst retreating from England, paid a domiciliary visit to the town of *Dumfries*; and for a misdemeanour committed against some of his followers on their march southward, the town was compelled to pay a fine, which amounted altogether to L.4000 sterling. In 1750, however, the crown granted to *Dumfries* L.2800 out of a forfeited estate.

Hosiery, leather, hats, wooden shoes, and baskets, are the only manufactures worth naming in *Dumfries*. Cotton checks at one time were woven on speculation in considerable quantities; but the trade has declined. The stocking trade gives employment to about 300 persons, and produces annually not less than L.20,000 sterling. The tanning trade, as regards money, is also considerable. An

Dumfries. extensive grazing district is fertile in hides, notwithstanding the great number of bullocks that are driven south; and in good years dressed leather brings a return amounting to about L.30,000. Wooden shoes or clogs were long peculiar to Dumfriesshire and the lower part of Galloway; but the trade is increasing, and promotes greatly the health of such as are exposed to outdoor labour. Of these shoes more than L.1000 worth are annually disposed of in Dumfries alone.

In the year 1831 the tonnage of Dumfries stood as follows: Foreign vessels inwards 1071 tons, coasting do. 20,463, goods 6320, coal 11,461, and lime 219; income to the commissioners of navigation L.870. 12s. 8d. In the same year vessels that cleared outwards paid duty on 5123 tons register, and on goods 2735 tons. Foreign vessels are charged at the rate of sixpence per ton, coasters twopence; goods one shilling and twopence, and lime and coal sixpence. The united income of the commissioners in the year above mentioned amounted to L.1072. 17s. 4d. The exports consist chiefly of grain, bark, wool, and hosiery; and the imports of coal, timber, and goods.

The infirmary was built more than fifty years ago, and the hospital or poor-house in 1753. Both are well endowed, though supported partly by subscriptions; and the former expends fully L.1000 annually on medicine and other necessary outlays. The infirmary, since the time it was founded, has received in the shape of donations L.18,000, and the hospital L.6000; and the expenditure of the latter is about L.600 annually. In connection with such institutions, it may be noticed that the town was some time since left nearly L.100,000 to be employed for charitable purposes. Dumfries possesses an excellent academy, where Greek, Latin, French, English, mathematics, geography, drawing, &c. are taught. It has also a very handsome theatre. In 1826 a gas-work was erected in Dumfries, and has since flourished well. There is a weekly market, which is held on Wednesday, when a great deal of business is transacted.

Since the year 1817, Dumfries has improved rapidly in appearance, although nearly stationary as to population. The High Street, which is broad and spacious, is one continued series of shops, which are nearly as handsome as the same description of buildings in Edinburgh or Glasgow.

St Michael's church-yard attracts the notice of all strangers. It is to a great extent a city of tombs, and has been frequently referred to as the Westminster of Scotland. Many of the monuments are very beautiful; and amongst these there is a sumptuous one over the ashes of the celebrated poet Burns.

The situation of Dumfries is admired by all tourists. With the exception of the point where it dips to the ocean, it is surrounded by a chain of hills, many of which are green to the top, and undulate in a very pleasing manner. In point of latitude, Dumfries is nearly a degree farther south than Edinburgh, and considerably more than a degree in climate. The chilling east winds which prevail so much on the east coast of Scotland are but little felt on the banks of the Nith; and pulmonary complaints, though not unknown, are comparatively unfrequent.

In 1831 the population of Dumfries, burgh and parish, was returned at 11,606 souls, being an increase on the preceding census of 554. Apart from the landward part of the parish, Dumfries contains about 9500 inhabitants. In Troqueer, on the opposite side of the river, the present population is 4665; but here again there is a distinction between the burgh and the parish, Maxwelltown containing above 3000 inhabitants, and the country part of Troqueer little more than 1000. Both localities are recognized in law, the one being a royal, and the other a burgh of barony of some standing; and as they are merely di-

vided by a running stream spanned by two stone bridges, Dumont. they may be considered as forming parts of the same town. The population in round numbers is 13,000.

DUMONT, ETIENNE, or STEPHEN, the friend, and often the Mentor, of Mirabeau, the redacteur of the principal works of Jeremy Bentham, and one of the most remarkable men of his time, was born in the month of July 1759 at Geneva, of which his family had been citizens of good repute from the days of Calvin. Shortly after his birth his father died, leaving a widow and five children wholly unprovided for. But the good widow, though placed in such destitute circumstances, and supported by little except the courage inspired by maternal affection, found means to educate her children in a place where necessary knowledge was accessible, and poverty not disgraceful. Induced by an anticipation of future eminence, seldom more happily realized, she accordingly contrived to send Stephen to the College of Geneva, where he justified her determination and the sacrifices necessary to carry it into effect, not only by his ability and proficiency, but by the virtuous purpose to which he turned his earliest attainments; for ere long, he not only defrayed the cost of his own education, but even contributed to the support of the family, by assisting the private studies of his comrades in the capacity of *répétiteur*; an office somewhat resembling that of a private tutor in our academical system, and having for its object to prepare the students for examination in the public class, by "grinding" them on the contents of the preceding lecture. Having completed his academical course, he took clerical orders; and in the year 1781 he was chosen one of the pastors of the city, where his talents as a preacher soon attracted general notice, and gave promise of his becoming one of the most brilliant and persuasive of pulpit orators. But the political troubles which disturbed Geneva in 1782 suddenly turned the course of his life into a different channel.

Two parties of opposite principles, one being attached to the authority of the magistrates, and the other anxious to extend the privileges of the people, but most widely separated as to the extension or limitation of the right of suffrage, had long divided that republic; and the disputes of these parties gained lustre from Jean-Jacques Rousseau, the most wayward, moody, and perverse of all the men of genius who have approached the borders of insanity, which, indeed, he appears more than once to have overpassed. The more liberal party received the name of *représentans*, or *petitioners*, from a representation presented by them against the legality of the proceedings of the magistrates respecting the writings and person of that celebrated but unhappy man; whilst, on the other hand, the magistrates, who refused the prayer of the petition, and their adherents who supported them in this refusal, were thenceforward called the *negatives*. During twenty years a struggle had been maintained between these parties with various success, but without bloodshed, though certainly not without violence. At length, in the autumn of 1782, when the petitioners had gained the ascendancy, the courts of Versailles and Turin, in concert with the canton of Berne, surrounded Geneva with an armed force, and, under pretence of some ancient guarantees, imposed a new constitution on the republic, and at the same time compelled the leaders of the representative party to fly from their country.

Dumont was not included in the proscription. But his heart had been touched with the love of liberty; he could endure chains nowhere patiently, and chains at home, where he was free by birthright, not at all. He therefore became a voluntary exile, and went to join his mother and sisters at St Petersburg, a city to which many Genevese had carried their honourable patrimony of ability and

Dumont. knowledge. In this he was probably influenced in part by the example of his townsman Lefort, who was the first tutor, minister, and general of the Czar. At St Petersburg he became pastor of the French church, an office he filled for eighteen months, during which time he obtained the consideration due to his great merit and excellent character. But his views were directed towards Great Britain, where most of the Genevese exiles had taken refuge, and where some of them were actually employed in negotiating with government for permission to establish a Swiss colony in Ireland. He left St Petersburg in 1785; and soon after his arrival in London went to reside with Lord Shelburne, then a minister of state, who confided to him the education of his sons. Lord Shelburne, afterwards Marquis of Lansdowne, a man distinguished for his cultivation of the society of men of letters, foreign as well as native, soon discovered the great talents of Dumont, who gradually became a friend, or rather member of the family; and it was at the house of this minister that he became acquainted with some of the most illustrious men of the country, amongst whom may be mentioned Fox, Sheridan, Lord Holland, and Sir Samuel Romilly. His connection with these and other distinguished individuals, founded upon friendship, similarity of opinions and literary occupations, and the pursuit of great objects of public utility, gave them full opportunities of appreciating his worth. He was generally known as a man of profound knowledge, correct judgment, irreproachable character, and brilliant wit, and esteemed for the possession of these high and invaluable qualities, which were exemplified throughout the whole course of his life.

About this time began his close connection with Sir Samuel Romilly, "a man," says Sir James Mackintosh, "whose whole excellence will be little understood by the world, until they see the narrative traced by himself of those noble labours of self-education, by which he taught himself every sort of ability which is necessary to serve mankind, and still more of that self-discipline by which he at length formed a character yet more exalted than his genius, composed of a probably unparalleled union of tender affection with unbending principle, and producing those dispositions towards the magnanimous and heroic which were hidden from the vulgar by the solemn decorums of a formal profession, and are seldom found to be capable of breathing so long under the undisturbed surface of a well-ordered and prosperous community. The habitual or mechanical part of Romilly's life was necessarily governed by those of his profession and country. The higher element, however, secretly and constantly blended itself with every thought and feeling; and there were moments when his moral heroism carried the majesty of virtue into the souls of the perplexed and affrighted vulgar." The friendship which united these two remarkable men increased daily; nor did its ardour or activity cease, until death unexpectedly rent asunder the tie which bound them together, and left Dumont inconsolable for the loss of his departed friend, whom he never mentioned without tears. There was a third in the circle, who is very strikingly described by Sir James Mackintosh.

"Among the closest friends of Romilly and Dumont was George Wilson, a man little known beyond the circle of his friends and that of his contemporaries in the profession of the law, and one whom it would be difficult to make known to others, without the use of that language of vague panegyric, the abuse of which had more lowered it in his own eyes, than even in those of most men of modesty and taste. It might be said by as unaffectedly conscientious a man as himself, if such another there be, that among those who thoroughly knew him, the degree of esteem for him was always considered as exactly indicative

of the degree of sagacity and purity of the man who entertained it. Yet even he was not more upright and benevolent than his two friends; though, having less vivacity than the one and less ardour than the other, he was not so liable to be allured by imagination from the rigid observance of the severe maxims of that moral prudence which is the safeguard of virtue. With a keen relish for pleasantries, and perfectly exempt from all gloom and harshness, he yet shunned the amusement of Wilkes's conversation, solely from deference to morality. When Mirabeau visited England about 1786, Wilson did not follow the example of his friends in cultivating the society of that extraordinary man, whose ill-trained fancies were better adapted to sudden felicities than to composition, and whose conversation was animated by an irregular benevolence, neither smothered by the profligacy of his youth, nor altogether extinguished by the intrigues and corruptions of his latter years."

In 1788 Dumont undertook a journey to Paris in company with Romilly; and it was under the auspices of the latter that he first became acquainted with Mirabeau. During a sojourn of two months in the French capital, he saw that extraordinary man almost every day; and a certain affinity of talents and pursuits led to an intimate connection between two persons diametrically opposed to each other in habits and in character. It was after his return from Paris that Dumont commenced his acquaintance with Mr Bentham; a circumstance which exercised a powerful influence over his future opinions, and, as it were, fixed his career as a writer on legislation. Filled with admiration for the genius of Bentham, and profoundly impressed with the truth of his theory, and the important consequences to which it immediately led, Dumont applied all his talents to make the writings of the great English jurist generally known, and devoted the greater part of his life in order to render available to the world at large the inexhaustible store of knowledge which the active mind of Bentham was continually increasing. We may mention here, that the following works are the result of that confraternity of genius, talents, and labour, which was thus established, viz. *Treatises on Legislation*, published in 1822, in 3 vols. 8vo, now (1833) in the third edition; *Theory of Punishments and Rewards*, 2 vols. 8vo, also in the third edition; *Tactics of Legislative Assemblies*, two editions, 1815 and 1822; *Judicial Evidence*, published in 1823, second edition 1830; and *Judicial Organization and Codification*, 1828, 8vo. Of course we make no mention here of the numerous editions published in foreign countries.

In the summer of 1789, that season of promise and of hope, especially to a Genevese exile, Dumont suspended his labours in England in order to proceed to Paris along with his friend Duroverai, ex-attorney-general of the republic of Geneva. The object of the journey was to obtain through M. Necker, who had just returned to office, and by means of the events which were then passing in France, an unrestricted restoration of Genevese liberty, by cancelling the treaty of guarantee between France and Switzerland, which prevented the republic from enacting new laws without the consent of the parties to this treaty. The proceedings and negotiations to which this mission gave rise, necessarily brought Dumont into connection with most of the leading men in the Constituent Assembly, and made him an interested spectator, sometimes even a participator, indirectly, in the events of the French revolution. The same cause also led him to renew his acquaintance with Mirabeau, whom he found occupied with his duties as a deputy, and with the composition of his journal, the *Courrier de Provence*, in which he was assisted by Duroverai, Clavière, and other Genevese patriots. For a time Du-

Dumont. Dumont took an active and very efficient part in the conduct of this journal, supplying it with reports as well as original articles, and also furnishing Mirabeau with speeches to be delivered or rather read in the assembly. This is now completely established by his highly instructive and interesting posthumous work entitled *Recollections of Mirabeau*. In fact, his friend George Wilson used to relate, that one day, when they were dining together at a table d'hôte at Versailles, he saw Dumont engaged in writing the most celebrated paragraph of Mirabeau's address to the king for the removal of the troops, which was believed to have been written by the orator himself. He also reported such of Mirabeau's speeches as he did not write, and, with a disinterested sacrifice of his own reputation to the diffusion of what he considered as truth, embellished and strengthened them from his own stores, which were inexhaustible. But this co-operation, so valuable for Mirabeau, and so self-devoted on the part of Dumont, was destined soon to come to an end; for, being attacked in pamphlets as one of Mirabeau's writers, he felt hurt at the notoriety thus given to his name in connection with a man occupying Mirabeau's peculiar position, and resolved to return to England, which he accordingly did in 1791. The reputation of being a subaltern writer was, as he himself states, by no means flattering; and the credit of an influential connection with a man whose character was far from being untainted alarmed his delicacy. He saw that he had no alternative but to put an end to a copartnership of which Mirabeau was certain to reap all the advantage, whilst the odium or discredit would alone fall to the lot of Mirabeau's associate; and he acted upon this conviction with a promptitude and decision worthy of his character.

In the eventful years which followed he continued to live chiefly at Lansdowne House, or at Bowood, where the most remarkable men of Europe as well as of Britain were frequent and welcome guests. Latterly, he began to form an intimate friendship with Lord Holland, whom he had known from childhood; and he became a member of the society of familiar friends, the habitual visitors at Holland House, who, during many years, saw a succession of celebrated guests of every country, party, religion, and of every liberal profession or station, which is likely to continue unmatched until another house be found that boasts such a master. "His mind was at that time in a most perfectly mature state, with much experience of very memorable events, and familiar intercourse with the most eminent men," besides an abundant store of amusing and striking anecdotes. "He had entirely subdued the popular and declamatory propensities which characterize youthful genius, yet without being in the least degree withdrawn from the love of letters and the delights of society by those scientific pursuits which occupied a subsequent period." In 1801 he travelled over various parts of Europe with Lord Henry Petty, now Marquis of Lansdowne, and brought back a fresher acquaintance with the mental occupations of the continental nations, from whom England had for years been separated by a wider and deeper channel than that formed by the hand of nature. But Dumont had then opened a new course of more serious occupations.

"In 1801 he published the *Traité de Législation*; the first fruits of his zealous labours to give order, clearness, and vivacity, to the profound and original meditations of Bentham, hitherto praised only by a very few patient readers, and but little better known, even by name, to the English than to the European public. The extraordinary merit of these writings, manuscript and printed, chiefly attracted his mind towards them; inferior circumstances, however, contributed their part to the fervour with which he devoted himself to them. Trained in the hasty and

shallow philosophy which then reigned, metaphysical principles were a novelty, in the contemplation of which he was too agreeably employed to examine the solidity of the foundation on which they rested. Wearied with the common-places of philanthropic declamation, which passed for philosophy, he ran with eagerness into the opposite extreme of new terms, dry definitions, and simple principles. The method of Bentham is undoubtedly a powerful instrument for the discovery of truth, especially in the juridical part of moral science. It is, however, a method which may become more than mischievous, by the very circumstance of its apparent perfection.

"Supposing every other objection to that system to be answered, it will still be evident that the value of its application in every particular instance must be in proportion to the exactness and completeness with which every circumstance is enumerated that can affect the determination of the question. But the enumeration is not complete, merely because the names of all such circumstances are enumerated. It is not thus that the philosopher proceeds in those sciences where the success is uncontested. He calculates the *degree* of every force that acts on a body; he ascertains the *proportion* of every element which goes to make up a compound; and an error in either of these respects is, in truth and effect, a want of exact and complete enumeration, which may lead to the most false results. Such mistakes in the physical sciences are easily detected. In the moral sciences it is extremely easy to seem to form a complete theory by such general and vague inductions, because the means of quick and palpable detection are wanting. Wherever analysis is *really* exhaustive, it is the most perfect of instruments; but where it only reaches a semblance of exactness, it produces or perpetuates error in the exact proportion of its seeming approach to truth. There is no remedy against this dangerous distemper but the habit of never forgetting that, in each case, the main question always must be, 'How much of each enumerated cause is likely to act in the instance before me?' No show of accuracy, no superiority of method, can dispense with this question, or enable any man to answer it otherwise than by approximation. But with these high and arduous matters we must not deal more largely in this place. The talent with which M. Dumont performed his task is as generally acknowledged as the perfect disinterestedness which led him to employ so much talent in expounding the opinions and enlivening the reasoning of others. It is due to him to say, that he always considered the system as a model, to be always consulted and approached, but never imposed without a cautious regard to circumstances. It must also be observed, that however entirely he adopted the speculations, delighted in the method, and even acquiesced in the language of Bentham, that for which he really felt a warm zeal, and consecrated the labour of his life, was the practical establishment of that grand reformation of law, which owes indeed much to the writings of Bentham, and to the discussions which they daily contribute to spread and keep up, but which, so far from being peculiar to him, is zealously supported by those who dissent from his moral theories, and was common to him, at least in that more obvious part of it which relates to criminal law, with the philosophers of the eighteenth century, who pursued the same object, though with less distinctness of view, less precision of language, and less knowledge of the abuses to be reformed. The mind of Dumont moved onward with that of the reformers of jurisprudence throughout Europe. He does not needlessly question the singularities of his venerable master; but his attachment was to the main stock of reforming principle. Those who knew him need not be reminded, that if his principles have any

Dumont.

Dumont. tendency to a cold and low morality, they were in that respect altogether defeated by the nature of Dumont; a man of the utmost simplicity and frankness, of a most unusually affectionate and generous disposition. A man of so much letters and wit could not have worked into his practical nature any indifference to art and accomplishment, to real learning, or to the only eloquence which deserves the name."

In 1814 the restoration of Geneva to independence induced Dumont to return to his native place, which he loved with that fervour which can only be felt by the citizen of a small republic. He was immediately chosen a member of the supreme council, and by conciliating opponents, moderating partisans, and gaining the confidence and respect of all, he became in time its chief leader and ornament, as he would have been in more conspicuous and powerful assemblies. At the time of his death he had completed a code of law; which, as chairman of a committee appointed for that purpose, it would have been his duty to present to the supreme council on its assembling after its vacation; but at the moment when he was thus about to engrave his name on the annals of his beloved country, and to honour her, by rendering her, as he hoped, an example to Europe, he was cut off in the full vigour of his faculties, and on the eve of their most conspicuous exertion. In the autumn of 1829 he undertook a tour of pleasure, or rather of relaxation, to the north of Italy, in company with one of his friends, M. Bellamy Aubert; and his family were impatiently expecting his return when they received the tidings of his death. He died at Milan, in October 1829, in the seventy-first year of his age.

Dumont was wholly untainted by political or philosophical bigotry, which has corrupted so many of those who inveigh against every form of that vice. His friends at Geneva, at Paris, or in London, were very far from sharing his peculiar opinions. Surrounded by fifty-three nephews or nieces in the first or second degree, the issue or progeny of three sisters, he treated them with a patriarchal tenderness very foreign from the scorn of some Epicureans for "the charities of father, son, and brother." In his will he leaves legacies to all; touchingly assuring them that they must not measure his kindness by his bequests. In every instance of the youngest child, he seems, with the most affectionate solicitude, to have weighed the needs and desires of each, and to have considered all their little claims as worthy of conscientious consideration. His will, which is dated in May 1826, opens with an acknowledgment worthy of him. "I begin this testamentary disposition by an act of gratitude towards God, for having blessed me with a peaceable and independent life, which has owed its chief happiness to the charm of study and the enjoyments of friendship." Such was Dumont, a pattern of wisdom and goodness, the like of which it is seldom indeed given us to contemplate, in the ordinary course of this rude and selfish world. (*Notice of M. Dumont* by Sir James Mackintosh, *Foreign Quarterly Review*, No. ix.; *Recollections of Mirabeau*, preface; *Bibliothèque Universelle*, November 1829; *Revue Encyclopédique*, vol. xiv. p. 258.) (A.)

DUMONT, John, a well-known publicist, was born in France in the seventeenth century. He followed the profession of arms, but not obtaining promotion so rapidly as he expected, he quitted the service, and travelled through different parts of Europe. He stopped in Holland with the intention of there publishing an account of his travels. But in the interval, at the request of his bookseller, he wrote and published several pamphlets, which were eagerly sought after, by reason of the unceremonious manner in which he treated the ministry of France. This freedom having

deprived him of all hope of employment in his own country, he now thought of forming a permanent establishment in that where he resided; and the knowledge which he had already acquired of the relations and interests of different nations having led him to entertain the idea of opening a course of lectures on public law, he lost no time in carrying it into effect. The project succeeded far beyond his expectations; and some useful compilations which he published about the same period made him favourably known in foreign countries. The emperor of Germany appointed him his historiographer, and some time afterwards conferred on him the title of Baron de Carlsroun. He died at Vienna in 1726, at an advanced age. Dumont wrote with facility, but his style is deficient in vigour and correctness; nevertheless, his works are esteemed as containing a great number of documents valuable for history. The following is a list of the works published by Dumont: 1. *Nouveau Voyage au Levant*, Hague, 1694, reprinted under the title of *Voyages en France, en Italie, en Allemagne, à Malte et en Turquie*, Hague, 1699, 4 vols. 12mo; 2. *Mémoires Politiques pour servir à la parfaite intelligence de l'Histoire de la Paix de Ryswick*, Hague, 1699, 4 vols. 12mo; 3. *Mémoires sur la Guerre présente* (1700), Hague, 1703, 12mo, reprinted under the title of *Recherches modestes des Causes de la présente Guerre, en ce qui concerne les Provinces Unies*, 1713, 12mo; 4. *Récueil de Traités d'alliance, de paix, et de commerce entre les Rois, Princes, et Etats, depuis la paix de Munster*, Amsterdam, 1710, 2 vols. 12mo; 5. *Soupirs de l'Europe à la vue du projet de paix contenu dans la harangue de la reine de la Grande-Bretagne*, 1712, 12mo; 6. *Corps Universel Diplomatique du Droit des Gens, contenant un Récueil des Traités de paix, d'alliance, etc. faits en Europe, depuis Charlemagne jusqu'à présent*, Amsterdam, 1626, and following years, 8 vols. fol. continued after Dumont's death by J. Rousset; and 7. *Batailles gagnées par le Prince Eugène de Savoie*, Hague, 1723. To the *Corps Universel Diplomatique du Droit des Gens* ought to be subjoined, 1. *L'Histoire des anciens Traités jusqu'à Charlemagne*, by Barbeyrac, 1739, in 2 vols. folio; 2. *Supplément au Corps Diplomatique, avec le cérémonial des Cours de l'Europe*, collected by Dumont, and arranged by Rousset, 1739, in 3 vols. fol.; 3. *Histoire des Traités de Paix du dix-septième Siècle*, by St Priest, 1725, in 4 vols. folio. Dumont was also the author of *Lettres Historiques contenant ce qui se passe de plus important en Europe*, 12mo. This periodical, which was commenced in 1692, and two volumes of which appeared annually, Dumont conducted till 1710, from which time it was continued by Basnage, with the aid of several collaborateurs, until 1728. The earlier volumes are much esteemed. (A.)

DUMPALIS, a spacious bay on the west coast of the island of Celebes, into which flow two considerable rivers. Good anchorage is found here, and the bay is much resorted to on account of the great quantity of fish which are found in it. At the bottom of this bay is situated the town of Dumpalis, which has a considerable trade. The inland merchants bring gold dust and a particular drug, which they dispose of to the inhabitants in the town, receiving in return tobacco, opium, white cloths, iron knives, and creeses. The natives here fight with poisoned barbed arrows, blown out of black ebony tubes; and are sure to kill at the distance of twenty yards.

DUN, or **BURGH**, the name of an ancient species of building, of a circular form, common in the Orkney and Zetland Islands, the Hebrides, and the northern parts of Scotland. The latter term points out the founders, who at the same time bestowed on them their native name of *borg*, a Sueo-Gothic word signifying a defence or castle; and the Highlanders universally apply to these places the Celtic name *dun*, signifying a hill defended by a tower, which

Dumpalis
||
Dun.

Dunaburg
||
Dunbar.

plainly points out their use. They are confined to the countries once subject to the crown of Norway. With few exceptions, they are built within sight of the sea, and several of them within sight of each other; so that, on a signal by fire, by flag, or by trumpet, they could give notice of approaching danger, and afford mutual support. In the Orkney and Zetland Islands they are most frequently called *wart* or *ward hills*, which shows that they were garrisoned. They had their wardmadher, or watchman, a sort of sentinel, who stood on the top, and challenged all who came in sight. The gackman was an officer of the same kind, who not only had to watch against surprise, but was also bound to give notice if he saw any ships in distress. He was allowed a large horn of generous liquor, which he had always by him, to keep up his spirits. Along the Orkney and Zetland shores they almost formed a chain, and by that means not only kept the natives in subjection, but were situated commodiously for covering the landing of their countrymen, who were perpetually roving on piratical expeditions. These towers were even made use of as state prisons; for we learn from Torfæus, that after Sueno had surprised Paul, count of Caithness, he carried him into Sutherland, and confined him there in a Norwegian tower. Out of this kingdom no buildings similar to these are to be found anywhere, except in Scandinavia. On the mountain of Swalberg in Norway is one; on the Stir-biskop, at Upsal, in Sweden, is another; and on Umsborg, in the same kingdom, is a third.

These towers vary in their inner structure, but externally they are universally the same, though some have an addition of strength on the outside. The burgh of Culswick, in Zetland, notwithstanding it is built on the top of a hill, is surrounded with a dry ditch thirteen feet broad; that of Snaburgh, in Unst, has both a wet and a dry ditch, the first being cut with great labour through the solid rock. The burgh of Moura is surrounded by a wall, now reduced to a heap of stones, and the inside is cylindrical, not tapering, as is usual with others. The burgh of Hogster, upon an isle in a loch of the same name, has also the addition of a wall; a peculiarity in a causeway to join it to the main land, and a singular internal structure. Numbers of little burghs, with single cells, are scattered about these islands, in the neighbourhood of the greater, and were probably built by the poorer sort of people, in order to enjoy their protection. A multitude of places in these islands have the addition of burgh to their names, notwithstanding there is not a vestige of a tower near them, the materials having long since been carried away and applied to various uses.

DUNABURG, a circle in the Russian government of Witebsk or Witepsk, formerly a part of Lithuania. It is bounded on the north by Livonia, on the east by Resitka, on the south-east by Wilna, and on the west by Courland. It is watered by the Düna, which is joined by other streams, and fertilizes the land, which is highly productive of rye and flax, and maintains a large stock of cattle. It contains three cities, one town, and 1078 villages, with a population in 1797 of 47,785, in 1827 of 61,500 inhabitants. The extent is 328 square miles, or 190,000 acres. The chief city, of the same name, is situated on the Düna. It was formerly fortified. It contains a Greek and a Catholic church, and 4000 inhabitants.

DUNBAR, a royal burgh, post, and market town of Scotland, in the county of Haddington, is pleasantly situated on a gentle acclivity rising from the shores of the German Ocean, near the mouth of the Frith of Forth. It consists of one main street, which runs the length of the town, with several others of smaller dimensions which intersect it. The whole has a neat and commodious ap-

pearance. Dunbar is a place of considerable antiquity, and, there is reason to believe, was built by the Picts. It originated in a castle, once of great strength and importance as a bulwark for the defence of this route into Scotland, against the invasion of the English. The site of the fortress was well chosen both for defence and convenience. The coast is here bold, and studded with rocky islets along and within the margin of the sea; and these in early times afforded room for the battlemented walls of a fort, which gradually increased by connection with the adjoining land, and with the islets by walls of great strength. It was thus admirably adapted to receive succour by sea, or allow the escape of its keepers with impunity. We find it mentioned as early as the year 856, and subsequently it stands conspicuously prominent in the various conflicts in which Scotland was embroiled. It endured several memorable sieges, the most remarkable of which was that by the English in 1337, when it was defended by a female member of the Douglas family. The place is now a total ruin. The harbour and quay of Dunbar are on a confined plan, and the usual depth of water is scarcely sufficient to float vessels of 250 or 300 tons burden. The main evil of the port arises from the existence of various craggy islets and sunken rocks near the entrance, which renders the navigation somewhat dangerous. Contiguous to the inner parts of the harbour are some large granaries and storehouses, a small graving dock, and other conveniences for shipping, which, however, exists here to a very limited extent. There is a market on Tuesday, and there are two fairs annually. Formerly Dunbar was famous for its herring fishery, but that branch of trade has now almost totally disappeared. The manufactories of the town are a soap-work, an iron foundery, and a manufactory of steam engines. There is also here some small trade in corn. The most remarkable house in Dunbar is a large plain mansion, situated at the west end of the town, the property and residence of the family of Lauderdale. In 1819 a handsome new church was erected upon the old site, which was founded in the fourteenth century. The new building is in the semi-gothic style, and is internally commodiously and elegantly fitted up. Besides this place of worship, there are two Seceder meeting-houses and a Methodist chapel. There are two public besides several private seminaries of education in the town; and the charitable and other institutions are also extensive. The town is governed by a provost and three bailies, a treasurer, town-clerk, and chamberlain, with fifteen members of council. The annual revenue of the burgh is about L.1300. Dunbar lies twenty-eight miles almost due east from Edinburgh. The population, including the country part of the parish, amounted in 1831 to 4735.

DUNBAR, WILLIAM, the most eminent of all the early Scottish poets, appears to have been born about the middle of the fifteenth century. Notwithstanding the high reputation which he enjoyed among his contemporaries, the records of his personal history and character are extremely scanty; and although he belonged to the church, his progress is not to be traced by successive preferments. He describes himself as a native of Lothian. Kennedy represents him as related to the earl of March; but this perhaps is only to be considered as a poetical fiction, introduced for the purpose of heightening his invective. His latest biographer however supposes that he may have been the grandson of Sir Patrick Dunbar of Beill in the county of Haddington, a younger son of George the tenth earl of March. "This Sir Patrick," we are informed, "signalized himself on many occasions, and was one of the hostages for James the First in 1426; and it also appears from an original charter, dated August 10th, 1440, that one of his sons was named William, who in all probability was either

Dunbar.

Dunbar. the father or uncle of the poet. No other person of the same baptismal name can be traced during the whole of that century; and as such names generally run in families, the circumstance of our author's alleged descent from the earls of March, in connection with his own avowal respecting his birth-place, adds some strength to the conjecture of his being the grandson of Sir Patrick Dunbar of Beill.¹ During the present age, the births, marriages, and deaths of persons possessing little property and less distinction may in a great variety of instances be very easily traced; but as the same diurnal records did not exist in the fifteenth century, it is only where names are connected with property, rank, or office, that in most cases we can succeed in an attempt to discover the outlines of private or domestic history. Neither the name nor the surname was uncommon: at that period Scotland certainly contained many Williams and many Dunbars; and if numerous instances of this combination of name and surname have not been detected, it is not difficult to assign a reason.

In the year 1477, William Dunbar of St Salvator's College took the degree of A. B. in the university of St Andrews; and as the statutes required the candidate to be of three years standing, he must have been matriculated in 1474. In 1479 he took the degree of A. M.² Whether this was the poet, or another individual of the same name, we have no means of ascertaining: but there is an apparent coincidence in the time; and the supposition that he studied at St Andrews, is highly probable in itself. There is likewise some reason to suppose that he studied in the university of Oxford: "Quod Dunbar at Oxenfurde," is the colophon of one of his poems; and we need scarcely remark that Oxenford was once the current name of this seat of the Muses. But it is also to be recollected that the poet might visit Oxford in some other capacity than that of a student. In his youth he appears to have been a novice of the order of St Francis. His sentiments with regard to this profession we are enabled to glean from one of his poems; and those sentiments we shall here endeavour to exhibit in plain prose. "Before the dawn of day," says Dunbar, "methought St Francis appeared to me with a religious habit in his hand, and said, go, my servant, clothe thee in these vestments, and renounce the world. But at the sight of him and his habit I was scared like one who sees a ghost. And why art thou terrified at the sight of the holy weed? St Francis, reverence attend thee, and thanks for this intended benefit; but with regard to those garments of which thou art so liberal, it has never entered into my mind to wear them: sweet confessor, take it not in evil part. In holy legends have I heard it alleged that bishops are more frequently canonized than friars; if therefore thou wouldst guide my soul towards heaven, invest me with the robes of a bishop. Had it ever been my fortune to become a friar, the season is now long past: between Berwick and Calais, in every flourishing town of the English dominions, have I made good cheer in the habit of thy order; in friar's weeds have I mounted the pulpit at Dernton and Canterbury, in them have I also crossed the sea at Dover, and instructed the inhabitants of Picardy; but this mode of life compelled me to have recourse to many a pious fraud, from the guilt of which no holy water could cleanse me. What had thus appeared to me as St Francis, was a fiend in the likeness of a friar: he vanished away with stench and fiery smoke; methought he carried one end of the house along with him, and I awoke like a wight in perplexity."³

From this and some other passages of his works, it is evident that Dunbar had in some degree imbibed the spirit of a reformer; and it is obvious that in all countries which have in any measure been extricated from the superstitions and delusions of the Romish church, the poets have contributed to prepare the way for the theologians. Wit and satire, when thus directed, are formidable weapons; and although ridicule is no test of truth, it has often been found a powerful instrument for exposing inveterate error. The best arguments may be employed in vain, and force commonly interposes in behalf of established opinions: but poets have in all ages claimed and exercised considerable freedom of animadversion; and, as light troops are sometimes more serviceable than the heavy-armed soldiery, the gay satirist is sometimes more successful in his attacks than the learned controversialist. Another inference to be drawn from this poem is equally obvious: as the author had preached in England and France, he must have been familiarly acquainted with the languages of both countries; or, if we suppose him to have preached at Canterbury in his native tongue, we must at least conclude that he spoke French when he instructed the inhabitants of Picardy. His travels are likewise mentioned in Kennedy's *Flyting*, where we must however make some allowance for satirical exaggeration.

Fra Atrik Forrest furth ward to Drumfreiss
Thow beggit with ane pardoun in all kirkis,
Collapis, crudis, meill, grottis, gryce, and geiss,
And undir nycht quhyllis thow stall staigis and stirkis.
Becauss that Scotland of thy begging irkis,
Thow schapis in France to be a knyght of the feild;
Thow hes thy clamschellis, and thy burdoun keild,
Unhonest wayis all, wolroun, that thow wrikis.⁴

Dunbar, in one of his invectives against Kennedy, has furnished us with some further information respecting his own adventures.

Or thow durst move thy mynd malitius,
Thow saw the saill abone my heid updraw;
But Eolus full woid and Neptunus,
Mirk and moneless, wes met with wind and waw,
And mony hundreth myle hyne coud us blaw
By Holland, Seland, Zetland, and Northway coist,
In desert [place] quhair we wer famist aw;
Yit come I hame, fals baird, to lay thy boist.

After the period of his travelling noviciate, Dunbar appears in the character of a court poet, and of a candidate for preferment in the church. On one occasion he speaks of his dancing "in the quenis chalmers."

Than cam in Dunbar the makkar,
On all the flure thair was nane frakkar,
And thair he daunsit the Dirrye dantoun;
He hoppet lyk a fillie wantoun,
For luiff of Musgraiffe, men tellis me;
He trippet quhill he tint his pantoun:
A mirrear dance mycht na man see.

Than cam in Maistriss Musgraiffe;
Scho mycht haiff lernit all the laiffe.
Quhen I saw hir sa trimlye dance,
Hir guid convoy and countenance,
Than, for hir saik, I wissit to be
The grytast erle or duik in France:
A mirrear dance mycht na man see.

But neither his dancing nor his solicitations seem to have procured him any considerable preferment. From the strain of his earlier compositions, it is evident that his first hopes were sufficiently sanguine, and from that of his

¹ Laing's *Memoirs of Dunbar*, p. 8.

² *Ibid.* p. 9.

³ *Dunbar's Poems*, vol. i. p. 28.

⁴ *Ibid.* vol. ii. p. 81.

Dunbar. later compositions, that those hopes had been completely frustrated. "Why shouldst thou," says the desponding poet, "be induced to hope for preferment, when an Italian impostor finds means to thrust himself into the chair of an abbot? How the affairs of the church are managed, I know not; but assuredly its benefices are not distributed with an impartial hand. While some enjoy seven, I am not possessed of one; and some, unworthy as they are to fill a stall, would fain climb to the rank of cardinal, a bishopric being too mean an object for their ambition." He addressed some stanzas to the king when many benefices were vacant; he frequently renewed his petition, and frequently complained that his life was suffered to wear away in fruitless expectation. From the wish which he expresses "To the King, that he war John Thomsounis Man," it may be inferred that Queen Margaret was anxious to promote his interest: the tenor of his prayer is, that the king were more subservient to the wishes of his consort.

My advocat, bayth fair and sweet,
The hale rejosing of my spreit,
Wald speid in to my errandis than,
And ye war anis John Thomsounis man.

Whether Dunbar's advancement was in any degree retarded by his own imprudence, can only be conjectured. The clergy of that age do not appear to have been generally promoted for their piety or learning; and so very moderate was the ordinary standard of external decency, that it must only have been the most gross and flagrant profligacy that could operate as a disqualification for preferment. It must however be acknowledged that some of his strains are highly reprehensible: his compositions are occasionally tinged with expressions which we cannot but regard as grossly indecent and profane; one of his addresses to the queen is such as might offend a modern courtesan; the more solemn observances of the church he has converted into topics of ridicule; the litanies are burlesqued in a parody which is not easily to be paralleled for its profanity. But it is more than probable that such indecent levities excited little or no disgust in his contemporaries: the age was not distinguished by any uncommon share of piety, nor had it attained to that degree of refinement which frequently secures a certain ostensible decorum, a decent appearance of virtue, where virtue itself is not to be found. To whatever cause his failure may be attributed, there is reason to suspect that he never obtained a benefice. But we learn from the public records that he was indebted to the king for a regular pension, as well as for occasional grants of money. The register of the privy seal, 15th August 1500, mentions a yearly pension of ten pounds, payable at Whitsuntide and Martinmas, to "Maister William Dunbar for all the dayis of his life," or until he should be promoted by the king to a benefice of the yearly value of forty pounds or upwards. It appears from the treasurer's accounts that the payment due at Martinmas 1501, was deferred on account of his being then in England; and it has been considered as "probable that he accompanied the ambassadors who were sent to England to conclude the negociations for the king's marriage in October 1501; and that he remained to

witness the ceremony of affiancing the princess Margaret, which took place at St Paul's cross, with great solemnity and splendour, on the 25th of January 1502. Under this supposition, we can have little hesitation in believing that Dunbar was the person then styled *the Rhymer of Scotland*, who received L.6. 13s. 4d. in reward from Henry VII. on the 31st of December 1501, and a similar sum on the 7th of January following.¹ He speaks of his long and faithful services to the king, and of his having been employed in many foreign countries, in England, Ireland, France, Spain, Italy, and Germany. Mr Laing conjectures, perhaps with sufficient probability, that in these extensive peregrinations he was attached to diplomatic missions, in which his knowledge of Latin and French might be available to persons of higher rank and inferior learning.

On the 17th of March 1504, or, according to our present computation, 1505, Dunbar for the first time said mass in the king's presence; and on that occasion he received a gratuity of seven French crowns, which was a larger sum than the king usually allotted for a priest's first mass. At the term of Martinmas 1507 his pension was increased to twenty pounds; and on the 26th of August 1510 it was increased to eighty pounds, to be paid during his life, or until he should be promoted to a benefice of the yearly value of one hundred pounds or upwards. How long he enjoyed this pension, and whether he ever exchanged it for a benefice, no research has yet ascertained.² On the 9th of September 1513 the king perished at Floddon-field; and there may be some reason to apprehend that his interest was not unaffected by that fatal event. From one of his poems, written "quhen the Governour past into France," it is evident that he must have survived for several years. John duke of Albany, regent of the kingdom, sailed for France in June 1517, again in October 1522, and finally in May 1524; nor can we safely decide to which of those three voyages the poet refers. It is at least certain that he was dead in the year 1530, when Sir David Lindsay composed his *Complaynt of the Papingo*.³ He describes himself as having attained to an advanced age; nor does he appear to have been so unwise as to continue his levities to the utmost verge of life; several of his poems are written in a moral and religious strain, not unbecoming an aged priest.

The poems of Dunbar are numerous and miscellaneous, but none of them extends to any considerable length. He evidently unites a brilliant imagination with an elegant taste; nor is he less conspicuous for his skill in the mechanical part of poetry. The elasticity of his mind and the versatility of his talents enabled him to arrive at eminence in different departments of composition: his allegorical poems display a rich and fertile invention; and he is equally distinguished for his powers of description and satirical humour. His diction is often remarkable for its terseness and forcible simplicity; but it is not always free from the vicious and pedantic phraseology with which the English poetry of that period is so deeply infected. Dr Nott observes that Dunbar, "a poet of a rich and lively fancy, and possessing great natural command of language," was nevertheless induced to use such pedantic diction as occurs in the opening of his beautiful moral

¹ Laing's *Memoirs of Dunbar*, p. 20.

² "The treasurer's accounts from the 8th of August 1513 (a month previous to the battle of Floddon) to the 25th of January 1515, which might have thrown some light on the subject, have not been preserved; and in those from that date to the 4th of September 1518 (from which time to the 5th of June 1522 there is another blank in the series) there is no mention of Dunbar's name. We cannot therefore discover the date of the last payment of his pension; but although we now lose all trace of his name, it by no means follows that his pension was entirely withdrawn: it might either have been transferred to some other branch of the royal revenue, or the poet might at last have been promoted to a benefice, when consequently his pension would cease." (*Laing's Memoirs of Dunbar*, p. 34.) The treasurer's accounts, 1st April 1513, mention a payment to Dunbar of so small a sum as forty-two shillings.

³ Lindsay's *Works*, vol. i. p. 285.

Dunbar. poem, entitled the Goldyn Targe.¹ He has employed a great variety of measures; and his versification, when compared with that of his most eminent contemporaries in both kingdoms, will in general appear highly ornamented and poetical.

Mr Ellis, after having quoted three of his shorter poems, subjoins the following remarks: "In these specimens we see much good sense and sound morality, expressed with force and conciseness. This indeed is Dunbar's peculiar excellence. His style, whether grave or humorous, whether simple or ornamented, is always energetic; and though all his compositions cannot be expected to possess equal merit, we seldom find in them a weak or redundant stanza."² The accomplished historian of English poetry likewise mentions him with no faint approbation. "I am of opinion," says Mr Warton, "that the imagination of Dunbar is not less suited to satirical than to sublime allegory; and that he is the first poet who has appeared with any degree of spirit in this way since Pierce Plowman. His Thistle and Rose and Golden Targe are generally and justly mentioned as his capital works: but the natural complexion of his genius is of the moral and didactic cast."³ But, subjoins Mr Pinkerton, "this remark must not be taken too strictly. The Goldin Targe is moral, and so are many of his small pieces; but humour, description, allegory, great poetical genius, and a vast wealth of words, all unite to form the complexion of Dunbar's poetry. He unites in himself, and generally surpasses, the qualities of the chief old English poets; the morals and satire of Langland, Chaucer's humour, poetry, and knowledge of life, the allegory of Gower, the description of Lydgate."⁴

But the most striking proofs of his genius are certainly to be found in his two allegorical poems. The Thrissill and the Rois was composed in celebration of the nuptials of James the Fourth and Margaret Tudor; an event productive of very important consequences to both kingdoms, inasmuch as it ultimately led to that happy union which the nature of the territory and the kindred origin of the people rendered so suitable and so desirable. In the plan of this poem Dunbar displays boldness of invention and beauty of arrangement; and some particular passages are remarkable for their strength and even beauty of colouring. The Goldyn Targe, which is written in a different stanza, is another allegorical poem of nearly equal merit. The golden targe, or the shield of reason, is found an insufficient protection against the assaults of the train of love.

Some of his short poems, of a serious character, are likewise to be distinguished from the ordinary compositions of that period. The stanzas bearing the title of Learning vain without guid Lyfe possess superior merit as a moral descant. His Meditation in Wyntir is also to be classed among the best of his serious pieces: some of the stanzas are beautiful and pathetic; and they may all be perused with more than common interest as the solitary musings of neglected genius.

Nor are his satirical less remarkable than his serious productions. His poem entitled the Dance of the seven Deidly Synnis presents many admirable strokes of comic and grotesque description. On the eve of Lent, the poet falls into a trance, and is presented with a glimpse of hea-

ven and hell. Mahoun, or the devil, proclaims a dance of those wretches who have died without absolution; he commands them to prepare a mummery, and to "kast up gamountis" according to the newest French fashion. The seven Deadly Sins immediately present themselves, and are each accompanied by a select band of votaries. Pride is with evident propriety represented as leading the dance, and is dressed in the first fashion of that period: his hair is thrown back, his bonnet is placed on one side of the head, and his gown flows to his heels in ample folds.

Lat se, quoth he, now quha begynnys:
With that the fowll seven Deidly Synnis
Begowth to leip at anis.
And first of all in dance was Pryd,
With hair wyld back, and bonet on syd,
Lyk to mak vaistie wanis;
And round about him, as a quheill,
Hang all in rumpillis to the heill
His kethat for the nanis.
Mony prowld trumpour with him trippit;
Throw skaldand fyre ay as thay skippit,
Thay gyrnd with hyddouss granis.

This group is succeeded by holy harlots; but Mahoun and the other fiends are not much entertained till a company of priests present their shaven crowns.

Heilie harlottis on hawtane wyiss
Come in with mony sindrie gyiss,
Bot yit luche nevir Mahoun,
Quhill priestis come in with bair schevin nekkis:
Than all the feyndis lewche and maid gekkis,
Black-belly and Bawsy-Broun.

Anger, who next makes his appearance, is very forcibly described in a single distich.

Than Yre come in with sturt and stryfe,
His hand wes ay upoun his knyfe.

He is attended by a band of ruffians, who follow in pairs, all equipped for war; and, as they move along, they frequently wound each other with swords and knives. The train of Anger is followed by that of Envy. He is attended by many a dissembler, flatterer, and back-biter, with "rownaris of fals lesingis," or whisperers of lies; from whom the poet cannot avoid expressing his regret that the courts of princes are never free. The next prominent figure in the dance is Covetousness, who is accompanied by catives, wretches, usurers, and hoarders of wealth. From their throats they discharge at each other torrents of molten gold; and when this ammunition is exhausted, the fiends replenish them with the same metal.

Nixt him in dans come Cuvatyce,
Rute of all evill, and grund of vyce,
That nevir coud be content:
Catyvis, wrechis, and ockeraris,
Hud-pykis, hurdaris, and gadderaris,
All with that warlo went.
Out of thair throttis thay schot on udder
Hett moltin gold me thocht a fudder,
As fyre-flawcht maist fervent;
Ay as thay tumit thame of schot,
Feyndis fild thame new up to the thrott
With gold of allkin prent.

Sloth, after being twice called, joins unwillingly in the dance, attended by many suitable companions. He drags

¹ Nott's Dissertation on the State of English Poetry before the Sixteenth Century, p. cxcii.

² Ellis's Specimens of the Early English Poets, vol. i. p. 385.

³ Warton's History of English Poetry, vol. iii. p. 109.

⁴ Pinkerton's List of the Scottish Poets, p. xciv.—"It is evident," says Dr Drake, "that a union of talents of this wide range must necessarily be of rare occurrence; nor can we wonder that a century should elapse before a poet in any high degree approaching the genius of Chaucer made his appearance in our island. Not indeed until Dunbar arose in the sister kingdom, had we another instance of the combination of first-rate abilities for humour and comic painting, with an equally powerful command over the higher regions of fiction and imagination." (Mornings in Spring, vol. ii. p. 4. Lond. 1828, 2 vols. 8vo.)

Dunbar. them along with a chain, and Belial lashes them on the loins; but their motion is nevertheless so tardy, that they are occasionally roused by being scorched in fire. The succeeding group consists of Lust and his loathsome train; he snorts like a stallion, is led by Idleness, and is attended by many foul associates who have died in their sins. When they engage in the dance, their visages become as red as the turkis stone. The foul monster Gluttony next presents himself, followed by many a drunkard and prodigal. When they become clamorous for drink, the fiends drench them with melted lead. All these terrific exhibitions might have been expected to satisfy Mahoun himself; but he is nevertheless pleased to close the entertainment with a Highland pageant.

Than cryd Mahoun for a Heleand padyane,
Syne ran a feynd to feche Makfadyane,
Far northwart in a nuke:
Be he the correnoch had done schout,
Ersche men so gadderit him abowt,
In hell grit roume thay tuke.
Thae tarmegantis, with tag and tatter,
Full lowd in Ersche begowth to clatter,
And rowp lyk revin and ruke.
The devill sa devit wes with thair yell,
That in the depest pot of hell
He smorit thame with smuke.

Dunbar's tale of "The twa maryit Wemen and the Wedo" presents us with the only specimen of blank verse which the ancient Scottish language affords. The rhythm is of that species which the author of *Piers Plowman*, or some of his predecessors, borrowed from the Anglo-Saxon poets, and which appears to have derived its origin from a remote era. It was employed by the Islandic as well as by the Anglo-Saxon poets, and was constructed with some degree of nicety.¹ Their lines are generally short, and they do not rigorously confine themselves to a definite number of syllables. Here alliteration supplies the place of rhyme; the corresponding sounds are at the commencement, not at the termination of words. In two contiguous and connected lines there must be three words beginning with the same letter; and, according to the strictest rule, two of those words ought to occur in the first, and the other ought to begin the second line. It was on such a model that Dunbar and the author of *Piers Plowman* constructed their verses, though they have not observed all the niceties of their predecessors. In the editions, and indeed in the manuscripts of their respective poems, what is exhibited as a single verse is in reality a distich, and admits of a division without any degree of violence.

This work of Dunbar presents us with a lively though indelicate picture of ancient manners, and is a very curious relique of ancient poetry. Bishop Percy considers it as equal to one of the most humorous productions of Chaucer. The peculiarity of the versification has compelled the author to adopt many uncouth terms; and accordingly the language of this tale is more difficult to be understood, and appears more obsolete, than that of his other poems; but his shrewdness of remark and strength of description shine through the mist of obscure phraseology in which they are sometimes involved. Soon after midnight in a

Dunbar. morning of June, the poet walks by a goodly garden, and, on hearing the sound of voices, is induced to look through the lofty hedge, when he perceives three ladies seated in a green arbour, and regaling themselves with wine: he secretly listens to their conversation, of which he professes to give a faithful report. As the wine circulates, they become more communicative, and, at the suggestion of the widow, they successively detail their experience of a married life. The sentiments which they utter, are as profligate as can well be imagined; and it is to be hoped that Dunbar did not intend this as a general representation of the ladies of his own age and nation.

Two of his satirical poems relate to a certain Italian, named John Damian, on whom James the Fourth had bestowed the abbacy of Tungland in Galloway. This adventurer appears to have been an empiric and an impostor, and to have persuaded the king that he had discovered the secret of converting baser metals into gold; nor is it surprising that Dunbar should feel some degree of indignation on seeing high preferment bestowed upon such a person. The abbot having failed to produce the promised gold, made a still more desperate attempt to maintain his reputation as an adept in science and art: he provided himself with a pair of wings, and appointed a particular day for taking his flight from the walls of Stirling castle; when the day arrived, he indeed plunged from the rampart, but instead of mounting in the air, he fell to the ground, and broke his thigh-bone. These anecdotes do not rest on the authority of a satirical poet, for this must commonly be regarded as a very dubious authority; but they are circumstantially related by Bishop Lesley in his history of that reign;² and the one account may so far be considered as a confirmation of the other, although the poet has added many particulars of ludicrous exaggeration. Thus, according to Dunbar's dream, he slew a friar in Lombardy, in order to obtain possession of his habit; and having fled to France, he began to practise physic, and in this way committed many new murders. The course of his adventures at length conducted him to Scotland, where he followed his leechcraft with similar success. When raised to the dignity of a prelate, he was not to be seen at mass; he did not appear at matins in his stole and scarf, but was generally to be found in his laboratory, as sooty as a blacksmith.

In lechecraft he was homicide;
He wald haf for a nycht to byd,
Ane haknay and the hurt mannis hyd,
So mekle he was of myans.
His irlis was rude as ony rauchtir,
Quhar he leit blude it was no lauchtir,³
Full mony instrumentis for slauchtir
Was in his gardyvians.

He couth gif cure of laxatif,
To gar a wicht horse want his lyf;
Quha evir assay wald, man or wyf,
Thar hippis yeid hiddy-giddy.
His praktikis nevir war put to preif
Bot sudand deid, or gret mischeif;
He had purgacioun to mak a theif
To de without a wedye.

¹ Wormii Literatura Runica, p. 178. Hafniae, 1636, 4to. Olafsen om Nordens gamle Digtekonst, dens Grundregler, Versarter, Sprog og Foredragsmaade, S. 57. Kiöbenhavn, 1786, 4to. Rasks Vejledning til det Islandske eller gamle Nordiske Sprog, S. 211. Kiöbenh. 1811, 8vo. Rasks Angelsaksisk Sproglære, S. 108. Stockholm, 1817, 8vo. Hickeys Grammatica Anglo-Saxonica, p. 195. 217. Bosworth's Elements of Anglo-Saxon Grammar, p. 215. Conybeare's Illustrations of Anglo-Saxon Poetry, p. lxxv. Percy's Essay on the Metre of Pierce Plowman's Vision: Reliques, vol. ii. p. 298. Whitaker's Introductory Discourse on P. Ploughman, p. x.

² Leslaeus de Rebus gestis Scotorum, p. 345. Romæ, 1578, 4to.—"Eadem tempestate rex (ut hoc quoque, quod vulgo non sine risu hucusque memoratur, dicam) Italum quendam, cujus faceto sermone ingenioque delectatus erat, abbatem Tunglandie creavit." See likewise Lesley's History of Scotland, p. 76. Edinb. 1830, 4to.

³ "Lors que mon frere fut en Escosse, il n'y avoit qu'un medecin, qui estoit medecin de la reyne, et de mon temps en Angleterre, il n'y avoit gueres de medecins. En Escosse un menuisier saignoit, et il y avoit des barbiers qui tondoient seulement." (Scaligerana, p. 223.)

Dunbar.

Unto no mess preissit the prelat,
For sound of sacring bell nor skellat;
As blak smyth brukit was his pellat,
For battiring at the study.
Thocht he come hame a newe maid channoun,
He had dispensit with matinnis cannoun;
On him come nothir stole nor fannoun,
For smwking of the smedye.

His unfortunate flight is afterwards related in a very ludicrous manner. The abbot of Tungland has furnished Dunbar with the subject of another poetical dream, which contains one passage remarkable for the strength of its satirical conception.

He sall ascend as ane horrible griphoun,
Him meit sall in the air ane scho dragoun;
Thir terrible monsteris sall togidder thriss,
And in the cludis gett the Antechrist,
Quhill all the air infeck of thair puyssoun.

Many of the comic and satirical compositions of Dunbar are valuable memorials of ancient manners; and, if incapable of gratifying the reader of taste, they are at least objects of curiosity to the antiquary. Of this description are the stanzas entitled the Devill's Inquest; which strongly evince that our ancestors were grossly addicted to profane swearing. "It might," as Dr Ogden remarks, "puzzle a philosopher to trace the *love of swearing* to its original principle, and assign its place in the constitution of man." This vice is now regarded as a characteristic of the vulgar, of those who are truly vulgar in their habits and associations, whatever may be their external circumstances; but during the age of Dunbar, it seems to have been practised by all ranks and denominations. To swear like a Scot, was once a proverbial expression.¹ In this general muster of swearers, the priest takes precedence.

Me thocht as he went throw the way,
Ane priest sweirit braid, be God verrey,
Quhilk at the alter ressavit he.
Thou art my clerk, the devill can say,
Renunce thy God, and cum to me.

Bishop Douglas, who certainly did not fall below the common standard of clerical decorum, has not scrupled to bedeck his compositions with abundance of oaths. The vice of profane swearing at length arrived at so scandalous a height as to require the interference of the legislature, and it was found necessary to extend the penalties to the clergy as well as the laity: by an act of Q. Mary in 1551, a "prelate of kirk," earl, or lord, was to be fined in twelve pence for the first offence committed within the next three months; different penalties were apportioned to different ranks during the first year; and for the fourth offence committed after the expiration of that period, a prelate, earl, or lord was to be banished or imprisoned for the space of a year and a day.²

Dunbar has left some examples of a motley species of composition, which at that period was not uncommon, and in which shreds of different languages are fantastically combined. It does not strictly come under the denomination of macaronic poetry, in which Latin are mingled with vernacular words of Latin terminations, and in which the rules of prosody are observed with at least some degree of care.³ The earliest macaronic poet is sometimes supposed to have been Teofilo Folengo, a Benedictine monk, better known by the name of Merlinus Cocaius, who was born near Mantua in the year 1491.⁴ Of his *Macaronics* the first edition bears the date of 1518; but during the preceding century a work had appeared under the title of "Typhis Odaxii Patavini Carmen Macaronicum de Patavinis quibusdam Arte magica delusis."⁵ This model was followed by Folengo, and by Antonius Arena, or Antoine du Sablon, a French lawyer; and these two are the most celebrated poets of this fantastic school. Among the Scottish poets they have found a few imitators, particularly Drummond and Dr Geddes. Dunbar has not adhered to the same model; without regarding the rules of prosody, he intermingles Latin with Scottish lines, and produces an effect sufficiently ludicrous. Of this particular mode of composition, much earlier specimens are to be found; and Dante himself has written a *canzone* which

Dunbar.

¹ "I have never been able to discover," says Lord Hailes, "from what cause our ancestors became so monstrously addicted to profane swearing. I remember Tom Brown some where uses, 'swear like a Scotsman,' as a proverbial expression. There certainly must be a tradition on the continent, that the inhabitants of the whole island were apt to swear in common conversation; for in Holland, the children, when they see any British people, say, 'there come the G—dams;' and the Portuguese, when they acquire a smattering of English, say, 'How do you do Jack, G—damn you?'—Queen Elizabeth was a common swearer." (Notes on Ancient Scottish Poems, p. 241.) Of the truth of one of these remarks we find a curious confirmation in the collection of Norman *chansons* subjoined to the "Vaux-de-Vire d'Olivier Basselin." Caen, 1821, 8vo.

Mauldicte en soyt trestoute la lignye!
Ils ont chargé l'artellerye sus mer,
Force bisquit et chascun ung bydon,
Et par la mer jusq' en Bisquaye aller
Pour couronner leur petit roy Godon.

Their little king G—damn was Henry the Sixth, who succeeded his father at a very tender age. The subsequent passage occurs in the works of Cretin, a Norman poet who wrote about the beginning of the sixteenth century. (Les Poesies de Guillaume Cretin, p. 163. Paris, 1723, 8vo.)

Cryant qui vive aux Godons d'Angleterre.

² Acts of the Parliaments of Scotland, vol. ii. p. 485. See likewise p. 482.

³ Dr Good has made the following remarks in reference to the English translators of Blainville's Travels through Italy: "When they tell us that macaronic poetry, which is a mixture of Italian and Latin words, possessing a Latin termination, 'is so called from its being supposed to resemble (as being a mixture) the Italian maccheroni, these being composed of flour, cheese, and butter'—they display a woeful ignorance of the subject they attempt to elucidate. Maccherone is a term in the Italian language, significative of a blockhead, an ignoramus, or in equivalent English a *pudding-pated* fellow: and Maccheronea (Macaronics) are obviously, therefore, burlesque imitations of the unclassical style of such writers." (Memoirs of the Rev. Alexander Geddes, LL. D. p. 256. Lond. 1803, 8vo.) The style of blockheads must generally be unclassical; but the origin of the term macaronic, as applied to this motley species of composition, is nevertheless very truly explained by the translators. For this explanation we have the authority of Folengo himself, who in the *Apologetica* prefixed to his *Opus Macaronicorum* speaks in the following manner: "Ars ista poetica nuncupatur ars macaronica, a macaronibus derivata, qui macarones sunt quoddam pulmentum, farina, caseo, botiro compaginatam, grossum, rude, et rusticum; ideo macaronice nil nisi grassedinem, ruditatem, et vocabulazzos debet in se continere." See likewise Menage's *Origini della Lingua Italiana*, p. 301.

⁴ Tiraboschi, Storia della Letteratura Italiana, tom. vii. p. 1469.

⁵ Morellii Bibliotheca Pinelliana, tom. ii. p. 456. Tiraboschi, tom. vii. p. 1463. Specimens of Macaronic Poetry, p. xi. Lond. 1831, 8vo.

Dunbar. contains a mixture of three languages, Latin, Romance, and Italian. It concludes with the following lines :

Chanson, vos pogues ir per tot le mond ;
 Namque locutus sum in lingua trina,
 Ut gravis mea spina
 Si saccia per lo mondo, ogn' uomo il senta :
 Forse pietà n' avrà chi mi tormenta.¹

Skelton, the contemporary of Dunbar, has occasionally indulged in this vein of humour ; and a poem of the same description occurs among the works of Dr Arbuthnot, though it has likewise been attributed to Meston. The following stanza, which forms the conclusion of Dunbar's Testament of Kennedy, may be considered as a sufficient specimen.

I will na priestis for me sing
 Dies illa, dies iræ,²
 Na yit na bellis for me ring,
 Sicut semper solet fieri ;
 Bot a bag-pipe to play a spryng,
 Et unum ail wosp ante me ;
 In stayd of baneris for to bring
 Quatuor lagenas cervisie,
 Within the graif to set sic thing
 In modum crucis juxta me,
 To fle the feyndis, than hardely sing
 De terra plasmasti me.

The Flyting of Dunbar and Kennedy is an extraordinary effort of unrefined wit ; and is at least sufficient to evince that the ancient Scottish tongue was not deficient in terms of abuse.³ Lord Hailes is inclined to believe that this altercation may have been a mere play of illiberal fancy, without any real quarrel between the antagonists ; and this opinion he supposes to be confirmed by the affectionate manner in which Dunbar afterwards speaks of Kennedy, and of Quintin Shaw, who in this literary duel seems to have acted the part of Kennedy's second. A similar altercation was maintained by Luigi Pulci and Matteo Franco : although for the amusement of their readers they loaded each other with the grossest abuse, yet the intimacy of their friendship is said to have continued without interruption.⁴ The example of Dunbar and Kennedy was followed by James the Fifth and Sir David Lindsay, and at a later period by Montgomery and Hume. It is not to be imagined that a king and one of his courtiers were engaged in actual hostilities ; and in the verses prefixed to the " Flyting betwixt Montgomery and Polwart," it is expressly stated that their altercation was not the result of a real quarrel, but of what is there described as generous emulation.

A comic tale, entitled the Freiris of Berwik, and possessing a large fund of genuine humour, seems to have been composed about the period to which our attention is now directed. Mr Pinkerton supposes it to have been written by Dunbar ; but this opinion is founded on no historical evidence, nor can the internal evidence of style and manner be considered as very striking or satisfactory. " But this tale," he remarks, " cannot at any rate be above thirteen years later than Dunbar, who must have died

about 1525. In 1482, Berwick was wrested from Scotland, and was ever after in the possession of the English. Now this poem speaks of all the monasteries as actually standing and flourishing while it was written ; and it is well known that in 1535 Henry VIII. suppressed the lesser monasteries, and in 1539 the greater. It follows that this tale must, at all events, have been written before 1539."⁵ But the poet, whoever he may have been, does not speak of the monasteries of Berwick as actually flourishing ; he merely avers, that when the adventures took place, friars of the different orders were not to seek, but were dwelling in the town. It is therefore evident that this chronological argument is by no means satisfactory, and that the tale may have been written after the suppression of the English monasteries.

In the Freiris of Berwik, every reader acquainted with the poems of Allan Ramsay must recognize the original of the Monk and the Miller's Wife ; and we will venture to add that the ancient is greatly superior to the modern tale. Ramsay's tale, says Lord Woodhouselee, " would of itself be his passport to immortality, as a comic poet. In this capacity he might enter the lists with Chaucer and Boccaccio, with no great risk of discomfiture. Though far their inferior in acquired address, his native strength was perhaps not widely disproportionate. Of this admirable tale, I conceive he has the merit of the invention ; as the story is not to be found in any of the older writers, as Sachetti, Boccaccio, or in the *Cento Novelle antiche*. In a few circumstances there is indeed a small resemblance to the 73d of the *Cent nouvelles Nouvelles*, entitled ' L'Oiseau en la Cage,' which barely affords a presumption that Ramsay may have read that story ; but in all the material circumstances, his Monk and the Miller's Wife is original. A story of more festive humour could not have been devised. The characters are sustained with consummate propriety ; the manners are true to nature ; and poetic justice is most strictly observed in the winding up of the piece."⁶ But whatever merit this comic tale may possess, it is evident that the praise of invention does not belong to Ramsay : he had doubtless read the old Scottish tale in Bannatyne's MS. from which he transcribed other poems less capable of arresting his attention. It may scarcely be worth while to remark that the ecclesiastic whom he introduces is a secular, a parish-priest, and is therefore most improperly described as a monk. That the author of the Freiris of Berwik was likewise indebted to some preceding poet, may perhaps be considered as highly probable. In the collection of Le Grand d'Aussy there is a *fabliau* which exhibits some lineaments of the story. A poor clerk, after having studied at Paris, is returning homeward without any money in his pocket, and, on the approach of night, calls at a solitary house to entreat a lodging ; but the farmer's wife very unceremoniously refuses to shelter him during the absence of her husband. As he is leaving the house, he observes a servant bringing some wine in a basket ; and at the same time the maid

¹ Opere di Dante Alighieri, tom. iv. p. 342. ed. Venezia, 1758, 4 tom. 4to.—Rodrigo de Valdes, a Jesuit, has written a long and extraordinary poem, containing a mixture of Latin and Spanish, and entitled " Poema heroyco Hispano-Latino panegyrico de la Fundacion y Grandezas de la muy noble y leal Ciudad de Lima." Madrid, 1687, 4to.

² This is an allusion to an ancient sequence, known to many English readers from the translations of Drummond and the earl of Roscommon. It begins in the following manner :

Dies iræ, dies illa
 Solvet seclum in favilla,
 Teste David cum Sybilla.

³ The Poems of William Dunbar, with notes, and a memoir of his life, by David Laing : to which are added Poems by Walter Kennedy, and other contemporaries. Edinb. 1833, 2 vols. 8vo.—Of the poems of Dunbar this is the first collective edition that has yet been undertaken ; and it is fortunate that the task was reserved for so industrious and so skilful an editor.

⁴ Roscoe's Life of Lorenzo de' Medici, vol. i. p. 252.

⁵ Ancient Scottish Poems, vol. ii. p. 394. Lond. 1786, 2 vols. 8vo.

⁶ Woodhouselee's Remarks on the Genius and Writings of Ramsay (p. cvii.) prefixed to his Poems. Lond. 1800. 2 vols. 8vo.

Dunbar. places in a cupboard a cake which she has just made, together with a piece of fresh pork which she has taken out of the pot. A priest, wrapped in his cope, soon afterwards passes the clerk in silence, and glides into the house. The wayfaring scholar, overwhelmed with fatigue, and dying of hunger, seats himself by the road-side: there he is found by the farmer, who happens to return sooner than he is expected; and they procure admittance, after the priest has found a place of refuge in the stable, which seems to be the ground-floor under the family-dwelling. While the maid is preparing some refreshment, the *laboureur* proposes that the clerk should either sing a song or tell a story: he declares that he knows neither song nor story, but offers to relate an adventure which happened to him in the morning; and by detailing this supposed adventure, he very dexterously contrives to take his revenge on the farmer's wife. As he was traversing a wood, he saw a numerous herd of swine: some of them were large, others small, some white, others black, in a word, they were of all sizes and of all colours; but above all he admired the leader of this herd; he was fat, shining, plump—in a word, just such another as must have been that, of which Catherine lately took a morsel from the pot. The clerk prosecutes his tale with the same arch simplicity, and contrives to reveal the secret of the wine, the cake, and finally of the priest concealed in the stable. The enraged farmer, having seized a cudgel, chastises his wife; and the priest, anticipating the same discipline, makes an attempt to escape, but is unmercifully beaten, stripped naked, and in this condition turned out of the house, leaving the clerk to enjoy his joke, together with the supper and wine provided for another guest.¹ This is certainly not the identical story of the Freiris of Berwick: several of the incidents are essentially the same, but the comic scene of the pretended conjuration is wanting. Still however the Scottish tale may have been borrowed from some preceding writer. A story not materially different occurs in a French collection published in 1665, and probably in many others: the scene is laid in Granada; the unfortunate gallant is an advocate, and the pretended magician a soldier.² This publication is indeed of a recent date; but such a tale is too pungent and characteristic to have been devised by the obscure compiler of the collection; and it is sufficiently probable that this tale and the Freiris of Berwick were both derived from one common source.³ Many stories, both tragic and humorous, seem to have passed with rapidity from language to language, even at a period when the different nations of Europe are generally supposed to have maintained but little intercourse with each other. In many instances it is by no means easy to account for this speedy transmission; but there were some peculiar circumstances which may be conceived to have had considerable influence; as, for example, pilgrimages to remote countries; the various missions and visitations of the clergy; the extensive journeys of merchants and their attendants; and the associations of people of different nations in the

same military service, particularly in the successive crusades. The original stock of materials is much more scanty than is commonly imagined; and the most distinguished writers of tales, whether in prose or verse, have very frequently contented themselves with borrowing the entire skeleton of a story, but from them it still derives its flesh and blood, its life and spirit; for in most instances the chief merit consists in the mode of telling the story, and not in the story itself. (x.)

DUNCAN, ADAM, LORD VISCOUNT, an illustrious naval commander, the second son of Alexander Duncan, of Lundie, in the county of Angus, Scotland, by Helen, daughter of Haldane of Gleneagles, in the county of Perth, was born in the month of July 1731. He received the rudiments of his education at Dundee, which is only about four miles distant from the family residence; and as his elder brother Alexander was designed for the army (in which he died lieutenant-colonel in 1771), Adam appears to have been early intended for the naval service. Accordingly, about the year 1746, he was placed under Captain Haldane, who then commanded the *Shoreham* frigate, and he remained two or three years with that officer. In 1749 he was entered as midshipman on board the *Centurion* of fifty guns, which then bore the broad pendant of Commodore Keppel, commander-in-chief on the Mediterranean station. In the beginning of 1755 he was promoted to the rank of lieutenant, and appointed to the *Norwich*, a fourth rate, one of the squadron under Keppel, destined to convoy to America the transports having on board the land forces commanded by General Braddock. After the debarkation of this armament he was transferred to the *Centurion*, where he continued until that ship returned to England; when Captain Keppel, who had for a short time commanded the *Swiftsure*, procured his appointment as second lieutenant of the *Torbay* seventy-four, to which he himself had just been appointed. Having remained on the home station for three years, he proceeded with the expedition sent against the French settlement of Goree, on the coast of Africa, and was slightly wounded in the attack of the fort, after which he became first lieutenant of the *Torbay*, and in this capacity returned to England. His promotion was now rapid. In September 1759 he was raised to the rank of commander; in February 1761 he was advanced to that of post-captain; and having been appointed to the *Vaillant*, of seventy-four guns, he again became connected in service with his original friend and patron Keppel, who, having received the command of the naval part of the expedition against Belleisle, now hoisted his broad pendant on board the *Vaillant*. After this affair Captain Duncan accompanied the commodore in the same ship to the attack of the Havanna, and commanded the boats in which the troops were landed, the commodore covering the disembarkation. He was afterwards very actively employed in the siege, during which he greatly distinguished himself; and when the town surrendered, he was dispatched to take possession of the Spanish ships in the harbour, being five of seventy and four of sixty guns.

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¹ *Fabliaux ou Contes du XII^e. et du XIII^e. Siecle*, tom. iv. p. 1. edit. Paris, 1781, 5 tom. 12mo.

² *Les Recreations Françaises; ou nouveau Recueil de Contes à rire; pour servir de divertissement aux melancholiques, et de joyeux entretien dans les cours, les cercles, et les ruelles*, part. i. p. 178. A Rouen, chés David Berthelin, dans la Cour du Palais, 1665, 2 part. 8vo.—The compiler, whose name is Nipe, professes to have gleaned from all the ancient and modern books of tales, and to have added new stories of his own invention, "plus capables de faire mourir de rire, que de faire dormir de bout."

³ A similar incident occurs in *Ravenscroft's London Cuckolds*, a Comedy, act ii. sc. ii. Lond. 1683, 4to. In reference to this scene, Langbaine has remarked that "Loveday's discovering Eugenia's intrigue, and pretending to conjure for a supper, is borrowed from *Les Contes d'Ouville*, part ii. pag. 235." (*Account of the English Dramatick Poets*, p. 421. Lond. 1691, 8vo.)

⁴ The earl of Orford professes to have derived the dreadful plot of his *Mysterious Mother* from an English tradition, though he afterwards discovered the supposed origin of this tradition in the novels of the queen of Navarre. A similar story, under the title of *La mayor Confusion*, occurs in the novels of Montalvan. (*Sucesos y Prodigios de Amor, en ocho Novelas exemplares*, f. 58. Sevilla, 1633, 4to.) The scene is laid in Madrid; and Bishop Taylor has quoted from *Comitolus* its exact parallel in "a strange and rare case happening in Venice." (*Ductor Dubitantium, or the Rule of Conscience*, vol i. p. 118. Lond. 1660, 2 vols. fol.)

Duncan.

After the capture of the Havanna, he, in the same capacity as formerly, accompanied Admiral Keppel, who had been appointed to the command on the Jamaica station, and continued with him as captain of the flag-ship until the conclusion of the war, when he returned to England.

On the recommencement of war with France in the year 1778, Captain Duncan was appointed to the *Suffolk*, of seventy-four guns; but before the end of the year he was removed into the *Monarch*, of the same rate, which, during the summer of 1779, was employed in the Channel fleet under Sir Charles Hardy, who, owing to the junction of the French and Spanish fleets, was now acting upon the defensive. Towards the close of the same year, the *Monarch* was one of the ships placed under the orders of Sir George Bridges Rodney, who had received instructions to force his way through all impediments into Gibraltar, and to relieve that fortress, then closely invested by a Spanish army on the land side, whilst it was blockaded on the seaward face by a flotilla sufficiently powerful to oppose the entrance of any ordinary force. In the beginning of 1780, the British fleet, when off Cape St Vincent, fell in with a Spanish squadron under Don Juan de Langara, which had been stationed there to intercept Sir George Rodney, who was supposed to have only a squadron of four sail of the line. On this occasion Captain Duncan carried the *Monarch* into action before any other ship of the fleet; and the *St Augustin*, of seventy guns, struck to him, after having been so much disabled that he was obliged to abandon her. In this action the disparity of force was great; the British fleet consisting of nineteen ships of the line, and the Spanish of only eleven ships and two frigates. Of the latter, four were taken, one was blown up, three surrendered, but afterwards got away much damaged, one was reduced almost to a wreck, and two others, together with the frigates, made their escape. Soon after his arrival in England Captain Duncan quitted the *Monarch*, and remained without employment until the beginning of 1780, when he was appointed to the *Blenheim*, of ninety guns, and continued in command of this ship during nearly the whole remainder of the war. He was constantly employed with the Channel fleet, then under the command of Earl Howe; and in September 1780, having accompanied his lordship to Gibraltar, he was appointed to lead the larboard division of the centre, or squadron of the commander-in-chief, and greatly distinguished himself in the encounter with the combined fleets of France and Spain, which took place off the entrance of the Straits. Soon after the return of the fleet to England Captain Duncan was removed into the *Foudroyant*, of eighty-four guns; and on the conclusion of the peace in the spring ensuing he passed into the *Edgar*, of seventy-four guns, one of the guard ships at Portsmouth, where, as is customary in such cases, he continued in command during the three succeeding years.

This was the last commission which he ever held as captain of a ship. In September 1789 he was promoted to the rank of rear-admiral of the blue, and in September 1790 he was made rear-admiral of the white; in February 1793 he was raised to be vice-admiral of the blue, and in April 1794 he became vice-admiral of the white; in June 1795 he was appointed admiral of the blue; and lastly, in February 1799 he received the rank of admiral of the white. But

during all these periods, excepting the two last, the merit of Admiral Duncan, which was never of an obtrusive, bustling, or forward kind, seemed to have been wholly overlooked; and though he frequently solicited employment, his applications proved unavailing; in consequence of which he had it in contemplation to retire altogether from the service. This period of obscurity, however, at length passed away. In February 1795 he received an appointment, constituting him commander-in-chief of the North Seas, that is, from the North Foreland to the Ultima Thule; and he accordingly hoisted his flag on board the *Prince George*, of ninety-eight guns, at Chatham, but afterwards shifted it to the *Venerable*, of seventy-four guns, the *Prince George* being considered as too large for the particular quarter in which he was destined to act. Having thus attained the object of his wishes, Admiral Duncan lost no time in proceeding to carry into execution the important trust which had been confided to him; and during the whole time he held the command, he exhibited that inexhaustible patience and unwearied constancy, which, with cool judgment and determined gallantry, formed the great attributes of his professional character. In the midst of many discouragements, and on a station exposed to peculiar dangers from the shoals and sand-banks which cover the coasts of the United Provinces, and the storms with which the North Sea is frequently visited, he never shrunk from the duty which had been assigned him, or failed at any season, however tempestuous, to show his squadron off the coast which it domineered over and insulted.

For more than two years, however, nothing occurred beyond the ordinary routine of such a service; namely, occasional captures, and smart affairs with the coast batteries and the craft which took shelter under their guns. The Dutch trade, however, was nearly annihilated; their merchant-vessels were frequently captured in sight of their own ports; and the whole coast was so completely blockaded that few vessels could venture out to sea, and escape the vigilance of the British fleet or its cruisers. The Batavian fleet, though consisting of five sail of the line, six frigates, and five sloops, was also obliged to remain quietly in port, or to confine itself to short cruises, at times when want of water or provisions compelled the British ships to repair for a few days to their own coasts; and in the beginning of June 1797, it even suffered itself to be blocked up in port, although for several days Admiral Duncan's force was limited to his own ship the *Venerable*, of seventy-four guns, and the *Adamant*, of fifty. This was owing to the unhappy and dangerous spirit of mutiny which at that period had infected in succession almost every portion of the British navy. It first broke out amongst the ships at Portsmouth, then extended itself to the fleet at the Nore, and afterwards reached the North-Sea fleet, in which almost every ship hoisted the flag of defiance. At this alarming and unprecedented crisis, the conduct of Admiral Duncan proved him to be equal to the fearful exigencies of the occasion, and perhaps contributed more to the safety and true glory of the country than even his subsequent victory. Although by the secession of the disaffected ships his fleet had been so thinned that, towards the end of May 1797, he found himself at sea with only his own ship and another, he nevertheless proceeded to his usual station off the Texel,¹ where

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¹ On the 3d of June 1797, Admiral Duncan having assembled the officers, seamen, and marines of his own ship (the *Venerable*), addressed them from the quarter-deck as follows:—"My lads, I once more call you together with a sorrowful heart, from what I have lately seen of the disaffection of the fleets; I call it *disaffection*, for the crews have no *grievances*. To be deserted by my fleet in the face of an enemy, is a disgrace which I believe never before happened to a British admiral; nor could I have supposed it. My greatest comfort, under God, is, that I have been supported by the officers, seamen, and marines of this ship; for which, with a heart overflowing with gratitude, I request you to accept my sincere thanks. I flatter myself, much good may result from your example, by bringing those deluded people to a sense of the duty which they owe, not only to their king and country, but to themselves. The

Duncan. there lay at anchor the Dutch fleet of fifteen sail of the line, under the command of Vice-Admiral de Winter; and in order to detain the latter in port until a reinforcement should arrive, he caused repeated signals to be made, as if to the main body of his fleet in the offing; a stratagem which, it was supposed, had the desired effect. At length, about the middle of June, several line-of-battle ships, in detached portions, joined the British admiral, and in a short time thereafter the two fleets were again placed on an equal footing.

But the Venerable having been upwards of eighteen weeks at sea, and during part of that time exposed to boisterous weather, was now in want of almost every description of stores; whilst others of the ships had also suffered by the recent gales, and were besides short of provisions. In these circumstances, the admiral, on the 3d of October, put into Yarmouth roads in order to refit and revictual; having left off the Dutch coast a small squadron of observation under the orders of Captain Trollope of the *Russell*. But early on the morning of the 9th, the *Black Joke* hired armed lugger showed herself at the back of Yarmouth sands with the signal for an enemy flying at her mast-head. Immediately all was bustle and preparation, and, by incredible exertions, Admiral Duncan, with eleven sail of the line, was enabled, a little before noon, to weigh and put to sea; directing his course with a fair wind right across to his old station. On the following day, the *Powerful*, *Agincourt*, and *Isis* joined, and on the afternoon of the 11th the advanced ships were near enough to count twenty-two sail of square-rigged vessels at anchor in the Texel. Meanwhile the admiral having received from Captain Trollope information of the course the enemy's fleet was steering, now stood along shore to the southward. At about seven on the morning of the 12th, the *Russell*, *Adamant*, and *Beaulieu* were descried in the south-west, bearing at their mast-heads the signal of an enemy in sight to the leeward; and about half-past eight, a strange fleet, consisting of twenty-one ships and four brigs, made its appearance in the quarter pointed out by the signal.

This was the Dutch fleet, under Vice-Admiral de Winter, consisting of four seventy-fours, seven sixty-fours, four fifty gun ships, two forty-four gun frigates, two of thirty-two guns, two corvettes, four brigs, sloops, and two advice-boats, all which had quitted the Texel at ten o'clock in the morning of the 10th, with a light breeze at east and

by north. As soon as Admiral de Winter had learned that the British fleet was approaching, he recalled some ships which he had previously detached, and edged away with the wind at north-west, towards Camperdown, the appointed place of rendezvous. At daylight on the 11th, the Dutch fleet was about nine leagues off the village of Scheveningen, in loose order; but on receiving additional information, Admiral de Winter ordered his captains to their respective stations, and, to facilitate the junction of the ships to leeward, stood towards the land. On the Wykerdens bearing east, distant about four leagues, the Dutch fleet hauled to the wind on the starboard tack, and shortly afterwards discovered the British fleet in the north-north-west; upon which it put about, and as soon as a close line was formed, with frigates and other smaller vessels opposite the openings, the Dutch ships throwing their main-top-sails aback, resolutely awaited the approach of the British.

When the Dutch appeared in sight, the British fleet was, owing to the inequality of the ships in point of sailing, in very loose order. To connect the squadron, therefore, and enable the heavy-sailing ships to take their allotted stations, the admiral made the signal to shorten sail, and bring to on the starboard tack; but observing, soon afterwards, that the Dutch ships were drawing fast in shore, and finding there was no time to be lost in making the attack, he made the signals to bear up, break the enemy's line, and engage them to leeward, each ship her opponent, and also for the van to attack the enemy's rear. In his dispatch the admiral states that his signals were obeyed with the greatest promptitude; but it has been asserted that, owing to the thickness of the weather, the signal to pass through the enemy's line and engage him to leeward was not generally understood during the short time it was displayed, and that hence some uncertainty prevailed in the fleet as to the precise mode of attack. In fact, the admiral perceived that if he waited to form line, there would be no action; and, with equal judgment and boldness, he dispensed with this preliminary arrangement, and notwithstanding the still disunited state of the ships, he hurried them into action as fast as possible. The signal above mentioned was replaced by that for close action, which continued flying for an hour and a half, until it was shot away by the enemy. This signal could not possibly be mistaken.¹

About forty minutes past twelve o'clock (12th October)

British navy has ever been the support of that liberty which has been handed down to us by our ancestors, and which, I trust, we shall maintain to the latest posterity, and that can only be done by unanimity and obedience. The ship's company, and others who have distinguished themselves by their loyalty and good order, deserve to be, and doubtless will be, the favourites of a grateful country; they will also have, from their individual feelings, a comfort which must be lasting, and not like the fleeting and false confidence of those who have swerved from their duty. It has often been my pride with you to look into the Texel, and see a foe which dreaded coming out to meet us. My pride is now humble indeed. My feelings are not easily to be expressed. Our cup has overflowed, and made us wanton. The all-wise Providence has given us this check as a warning, and I hope we shall improve by it. On Him, then, let us trust, where our only security can be found. I find there are many good men among us: for my own part, I have had full confidence of all in this ship, and once more beg to express my admiration of your conduct. May God, who has thus far conducted you, continue to do so; and may the British navy, the glory and support of our country, be restored to its wonted splendour, and be not only the bulwark of Britain, but the terror of the world. But this can only be effected by a strict adherence to our duty and obedience; and let us pray that the Almighty God may keep us in the right way of thinking. God bless you all." If this speech has but little to recommend it on the score of rhetoric, it has qualities of a nobler kind to compensate for the want of the graces of diction or oratory: it is indeed affecting and impressive in a very high degree; and it is recorded that, among the crew of the Venerable who listened to it, there was not a dry eye when the good admiral had concluded his address.

¹ The following anecdote, which is told by Admiral Sir Charles Ekins (*Naval Battles*, p. 236), shows that the instinct of true valour sometimes supplies the place of knowledge, if not of genius. Captain Inglis of the *Belliqueux*, sixty-four guns, owing either to long absence from active service, or an inaptitude for the subject sometimes apparent in naval officers, had neglected to make himself competently master of the signal-book; and hence, on the morning of the day of battle, when it became necessary to act with promptitude, in obedience to the signals, he found himself more puzzled than enlightened by it; so, throwing it with contempt upon the deck, he exclaimed in broad Scotch, "Damn me, up wi' the hellem, an' into the middle o't." In this manner he bravely anticipated the remedy in such cases provided by the illustrious Nelson, who, in his celebrated *Memorandum* on the eve of the battle of Trafalgar, observed, that "if a captain should be at a loss, he would not do *very wrong* if he laid his ship alongside of the enemy." In strict conformity with this doctrine, the *Belliqueux* was carried by her brave and honest captain into the very thickest of the fight, and got very roughly handled by the van of the enemy.

Duncan. the action commenced, when Vice-Admiral Onslow in the *Monarch*, which led the advanced or larboard division of the British fleet, cut through the Dutch line between the *Haerlem* and *Jupiter*, pouring into each in passing a well-directed broadside; and then leaving the *Haerlem* to the *Powerful*, luffed up alongside of the *Jupiter*, upon which the two ships became warmly engaged. In rounding, the *Monarch* received the raking fire of the *Monnikendam* frigate and the *Atalanta* brig, stationed in the rear or second line. The remaining ships of the larboard division, particularly the *Monmouth* and *Russell*, were soon in action with those of the enemy's rear; amongst which the last to surrender was the *Jupiter*, which had been first engaged. About twenty minutes after the *Monarch* had passed through the Dutch line, the *Venerable*, frustrated in her attempt to pass astern of the *Vryheid*, by the promptness of the *States-General* in closing up the interval, ran under the stern of the latter, and soon compelled her to bear up; whilst the *Triumph*, the *Venerable's* second astern, found immediate employment for the *Wassemaer*, the second astern of the *States-General*. In the meanwhile the *Venerable* had ranged up close on the lee-side of the *Vryheid*, with which, on the opposite side, the *Ardent* was also warmly engaged, and, in front, the *Bedford*, as she cut through the enemy's line astern of the *Gelykheid*. The *Brutus*, *Leyden*, and *Mars*, not being pressed by opponents, advanced to the assistance of their admiral, and did considerable damage to the *Venerable*, *Ardent*, and other ships of the British van. At this time the *Hercules*, having caught fire on the poop, bore up out of the line, and came drifting near the *Venerable* to leeward; but although the Dutch crew contrived to extinguish the flames, yet having thrown their powder overboard, they were compelled to surrender their ship to the nearest opponent. The *Venerable*, which had sustained serious damage, was now obliged to haul off, and to wear round on the starboard tack. As soon as this was observed, the *Triumph*, which had compelled the *Wassemaer* to strike her colours, approached to give the finishing blow to the *Vryheid*, which still persisted in defending herself. At length, from the united fire of the *Venerable*, *Triumph*, *Ardent*, and *Director*, the three masts of the gallant ship fell over her side, and disabled her starboard guns; upon which the *Vryheid* dropped out of the line an ungovernable hulk, and then struck her colours. With the surrender of De Winter's ship the action ceased, and the British found themselves in possession of the *Vryheid* and *Jupiter*, seventy-fours; *Devries*, *Gelykheid*, *Haerlem*, *Hercules*, and *Wassemaer*, sixty-fours; *Alkmaar* and *Delft*, fifties; and the frigates *Monnikendam* and *Ambuscade*. The victors then hastened to secure their prizes, in order that, before night-fall, they might get clear of the shore.

This battle presented on both sides the singular spectacle of heroic courage and determined perseverance, contrasted with conduct little, if at all, short of downright cowardice or disaffection; and from first to last the opposing forces were, from various causes, pretty nearly equal. Seven Dutch line-of-battle ships quitted the action in order to return home, and nearly as many British seem scarcely to have entered it. The actual combatants, however, maintained the strife with fierce, unflinching valour; and hence the loss on both sides was proportionally severe. That of the British amounted to 203 killed and 622 wounded, while the Dutch had 540 killed and 620 wounded. During the action the latter directed their shot solely at the hulls of their adversaries, and this not until they were so near that scarcely any aim could miss; which accounts for the unusual severity of the loss sustained. On the other hand, the captured ships were all either dismasted outright, or so injured in their masts

that most of these fell in the passage home; whilst as to their hulls, they were completely riddled, and only worth bringing into port as trophies of the victory. Duncan.

If any proof were wanting of the superior efficacy of Admiral Duncan's mode of attack, it would be found, first, in a manly declaration made by the gallant Dutchman, and, secondly, in the practical testimony to its excellence borne by Lord Nelson. "Your not waiting to form a line," said De Winter to Admiral Duncan, "ruined me; if I had got nearer the shore, and you had attacked, I should probably have drawn both fleets on it, and it would have been a victory to me, being on my own coast." And after the battle of the Nile, Nelson, although unacquainted with Lord Duncan, wrote his lordship to tell him how he, Nelson, "had profited by his example." Besides, the British squadron was composed of very indifferent and inadequate ships; many of them having been intended for Indiamen, and otherwise ill conditioned and deficient. Had Lord Duncan's fleet been composed of the same materials as Lord St Vincent's, every Dutch ship would have been taken; and had all the ships imitated the example of their chief, the same result must have followed. Few people are aware of the merits of the chief on that memorable day. When the action ceased, the ships were in nine fathoms water, within five miles of a lee shore, with every appearance of the gale which followed; a situation as critical as it is possible to imagine. And it should also be recollected, that when the Dutch put to sea, the admiral had only been two days in port, after a blockade of nineteen weeks. It was the opinion of Lord Duncan that, upon such occasions, the commander-in-chief should hoist his flag on board of a frigate; and he stated that, if he should ever fight another battle, he would certainly do so. He was often heard to declare that, if his flag had been flying on board of a frigate in this action, not one of the Dutch fleet would have escaped.

No victory was ever more seasonable, none more gratifying to the nation, than that of Camperdown. Politicians beheld in it the annihilation of the marine of Holland, long our most formidable rival on the seas; naval men admired the promptitude, decision, and address displayed by the admiral in approaching to the attack, in circumstances altogether unprecedented; and the people at large were transported with admiration and delight, though they did not very well know why. Hence the honours which were immediately conferred on the admiral received the approbation of all parties. On the 21st of October he was created Lord Viscount Duncan of Camperdown, and Baron Duncan of Lundie, in the county of Angus; his second in command, Vice-Admiral Onslow, was made a baronet; gold medals were struck and presented to the flag officers and captains; and the thanks of parliament were voted to the fleet. A pension of L.2000 per annum was likewise granted to Lord Duncan for his own life, with remainder to the two next heirs of the peerage.

After the victory of Camperdown, Lord Duncan continued to hold the same command until the commencement of 1800, when, being advanced in years, he withdrew from the service, and passed the remainder of his life in retirement, chiefly at his patrimonial residence. At the period of his death, however, which happened on the 4th August 1804, he was, we believe, about to be recalled into active service; and he had signified his determination to obey the call of his country at a season of unexampled difficulty and danger, when his career was terminated for ever by a sudden and fatal illness. In June 1777 he had married Henrietta, daughter of the Right Honourable Robert Dundas, lord president of the Court of Session in Scotland, and father of Lord Viscount Melville; and by this lady he had a large family. Lord Duncan was suc-

Duncan's Sugar Loaf
Duncombe. succeeded in his titles and estate by his second son, Robert, now Earl of Camperdown.

Lord Duncan was a man as remarkable in appearance as he was distinguished for character and worth. In person he was of a colossal and athletic form, six feet four inches in height, erect in his carriage, and, notwithstanding his great size, graceful in his movements, with a countenance strongly expressive of intelligence and benevolence. In him, singular meekness of disposition, extreme modesty in all that concerned himself, and the most unaffected dignity of mind, were blended with genuine spirit, high professional genius, vigorous and active wisdom, singular alacrity and ability for performing great achievements, and a decided indifference about success, excepting in as far as it might contribute to advance the good of his country. His private character was that of a man most exemplary in all the social relations of life; an affectionate relative, a steady friend, and a pattern of virtue and true piety. Lord Duncan was a most sincere and devout Christian, nor did he ever lose sight of the duties belonging to that character. He encouraged religion by his own practice, and, wherever he held a command, caused the public observance of it to be maintained. Immediately after the victory, which has immortalized his name, was decided, he ordered the crew of his ship to be called together, and, at their head, upon his bended knees, in the presence of the Dutch admiral, who was greatly affected with the scene, he solemnly offered up praise and thanksgiving to the God of battles for having crowned with success the arms of his country. In like manner, when all eyes were upon him, in the cathedral of St Paul's, on the day of general thanksgiving, in December following, his demeanour was so humble and devout, as not only to increase the admiration which his services had otherwise gained him, but to impress on all present a sense of the real dignity as well as importance of religion. In a word, Lord Duncan afforded a conspicuous instance of the truth of the remark, that piety and true courage are naturally allied, and that death loses its terrors to those who have placed their hope beyond it. (Collins's *Peerage*, by Sir E. Brydes; *Naval Chronicle*, vol. iv.; Charnock's *Biographia Navalis*; Chalmers's *Biographical Dictionary*, art. *Duncan*; James's *Naval History of Great Britain*, vol. ii.; Ekins's *Naval Battles*, p. 231.) (A.)

DUNCAN'S SUGAR LOAF, an island in the Mergui Archipelago, of a triangular form, about six miles in circuit, near the south coast of the island of St Matthew. Lat. 9. 42. N.

DUNCHURCH, a small town of the hundred of Knightlow, in the county of Warwick, eighty-one miles from London. It is situated on what was once a heath, celebrated for an ancient legend of the Dun Cow, some of whose bones are still affirmed to be preserved there. The inhabitants amounted in 1801 to 1087, in 1811 to 789, in 1821 to 947, and in 1831 to 1029.

DUNCOMBE, WILLIAM, younger, son of John Duncombe of Stocks, in Hertfordshire, was born in London in January 1690. He published in 1722 a translation of Racine's *Athalie*, which was well received by the public, and has gone through three editions. In 1724 he was editor of the works of Mr Needler; in 1735, of the poems of his deceased brother-in-law Mr Hughes, two vols. 12mo; in 1737, of the miscellanies of his younger brother Mr Jabez Hughes, for the benefit of his widow, in one volume 8vo; and in 1745, of the works of the Rev. Samuel Say, in one vol. 4to. In 1726 he married the only sister of Mr John Hughes, whom he long survived. In 1734 his tragedy of Lucius Junius Brutus was acted at Drury Lane Theatre. It was published in 1735, and again in 1747. The works of Horace, in English verse, by several

hands, were published by him in two vols. 8vo, with notes, in 1757; and a second edition, in four vols. 12mo, with many imitations, appeared in 1762. In 1763 he collected and republished "Seven Sermons by Archbishop Herring, on public occasions, with a biographical preface." He died in February 1769, at the age of eighty.

DUNDALK, a seaport town of Ireland, in the county of Louth, about forty miles from Dublin. It is a large and thriving town, with a wide street nearly a mile in length, and a very fine market-house near the entrance from Dublin. In the reign of Edward II. it was a royal city, the last we read of where a monarch of all Ireland was actually crowned and resided. It was formerly very strong, and had many towers and small castles in it. The bay has good moorings at all times, and from four to above eight fathoms water, with very good landmarks, either for bringing up to or making the harbour. In crossing the bar at high water, or ordinary neap tides, there is from fifteen to eighteen feet water. The manufacture of cambric was established in this town in 1737, for the first time in Ireland, and it has ever since flourished. Muslin is also made here, and corn is exported. It is the assize town of the county. The population amounts to 10,078.

DUNDAS, HENRY, VISCOUNT MELVILLE, a late eminent British statesman, was born about the year 1741. He was a younger son of the Right Honourable Robert Dundas, lord president of the Court of Session in Scotland, by Miss Gordon, a daughter of Sir William Gordon of Gordonston, Bart. He was educated at the High School and University of Edinburgh, and having been brought up to the profession of the law, was admitted a member of the Faculty of Advocates in the year 1763. He soon distinguished himself at the bar, and rapidly attained to extensive practice. The first promotion he obtained was the situation of one of the assessors to the magistrates of Edinburgh; after which he became successively an advocate-depute and solicitor-general. In 1775, when Sir James Montgomery was appointed lord chief baron, Mr Dundas succeeded him in the office of lord advocate, which situation he continued to occupy until 1783. In the month of March 1777, he was appointed joint keeper of the Signet for Scotland.

From the period of his appointment to the office of lord advocate, Mr Dundas in a great measure abandoned the ordinary practice of the bar, and devoted himself to public business. In 1774 he became a member of parliament, having been elected representative for the county of Edinburgh. Some years afterwards he resigned the representation of the county in favour of the late lord chief baron of the Court of Exchequer, and was chosen member for the city of Edinburgh, which he continued to represent until his advancement to the peerage. Although originally returned to parliament in opposition to the ministerial interest, he soon joined the party in power, and became a strenuous supporter of Lord North's measures during the American war. He frequently spoke in the House of Commons, and, notwithstanding the disadvantages of an ungraceful manner and a provincial dialect, he was always listened to with great attention, on account of the clearness of his statements and the weight of his arguments.

In the year 1782, Mr Dundas was admitted a member of the Privy Council, and appointed treasurer of the navy, under the administration of the late Marquis of Lansdowne, then Earl of Shelburne; and he continued to fill that office, and to support the measures of government, until the dissolution of that ministry. During the short coalition administration he was out of place, and made a conspicuous figure in opposing the memorable East India bill, a measure which occasioned the overthrow of the

Dundalk
Dundas.

Dundas. ruling party. Upon that occasion he displayed a knowledge of the affairs of the East India Company, which was evidently the result of much study and laborious investigation. In the month of December 1783, when Mr Pitt became prime minister, Mr Dundas was restored to the same office which he had previously held; and was appointed president of the board of control, under the new East India system. In 1791 he became a member of the cabinet, in consequence of his appointment to the office of principal secretary of state for the home department. The duties of this office he discharged with energy and ability. The volunteer system, which, undoubtedly, contributed much to rouse the spirit of the country during a period of peculiar difficulty and danger, has been ascribed to Mr Dundas. On the accession of the Duke of Portland to the administration of Mr Pitt, he resigned the home department, and became secretary at war. At this time he also held the offices of lord privy seal, and governor of the Bank of Scotland, and enjoyed an extent of patronage in his native country, which has seldom or never fallen to the share of any individual, and has been considered by many as more exclusive than can be safely confided to the hands of any one man. For many years he was the intimate friend and coadjutor of Mr Pitt, and took a leading part in all the important measures of his administration. The details of these measures, and Lord Melville's conduct in regard to them, belong to history. In the present article we must restrict ourselves to a general outline of the events of his life, and a short summary of the leading traits of his character.

Upon the resignation of Mr Pitt in 1801, Mr Dundas also resigned his political offices; and in 1802, under the administration of Mr Addington, afterwards Lord Sidmouth, he was elevated to the peerage, by the titles of Viscount Melville and Baron Dunira. The last public situation which he held in the government was that of first lord of the admiralty, to which he was appointed, on Mr Pitt's return to power, in the room of Lord St Vincent. It was in his administration of the affairs of the naval department that his lordship incurred that irregularity relative to the balances of public money remaining in his hands, which produced his celebrated impeachment. We conceive it unnecessary to dwell upon the proceedings of that well-known trial. It is sufficient to say that the House of Lords finally acquitted him of all the charges brought forward in the articles of impeachment exhibited by the Commons; but he had previously resigned all his offices in the administration.

Subsequently to his acquittal, Lord Melville was restored to his seat in the privy council; but he did not return to office. He sometimes took a share in the debates in the House of Lords; and, in 1810, he brought forward a motion, the object of which was to recommend the employment of armed troop-ships, instead of hired transports, for the accommodation of such troops as it might be found expedient to embark in furtherance of the public service. But the greater part of his time was spent in Scotland, where he died suddenly, at the house of his nephew, the Right Honourable Robert Dundas, lord chief baron of the Exchequer, on the 27th of May 1811, at the age of seventy-one. He appeared in his usual health for some time preceding; and his death is supposed to have been hastened by the affection he felt for the loss of his old and valued friend the Lord President Blair, who died a few days before.

In his person Lord Melville was tall, stout, and well formed. In public life he was principally distinguished by his great capacity for business, by the unwearied attention which he paid to the details of all official measures, and by the manliness and decision of his conduct. For many years,

as we have already observed, he was the steady friend and firm supporter of the measures of Mr Pitt, to whom he proved a very powerful auxiliary. Whilst he held the offices of treasurer of the navy, and first lord of the admiralty, his exertions are admitted to have been attended with great advantage to the public service. He devised several improvements in the details of that department, which have been found of great utility; and, in particular, the regulations with regard to the payment of seamen's wages, transmission of letters, and other matters connected with that branch of the public service, contributed much to the comfort of that class of men, and are highly honourable to the character of their author. In parliament he was a clear, acute, and argumentative speaker. His eloquence, however, was that of a man possessed of strong natural talents, wholly unadorned by literary taste or acquirements; and his speeches produced their effect from the solidity of his arguments, and the fearlessness with which he delivered his opinions, not from any powers of oratory or graces of style. The ornamental parts of eloquence, indeed, he seemed to despise, and was satisfied to bring his audience at once to the object he had in view. Political power was his passion, and the bustle of official life was the element in which he loved to move.

In private life his lordship was a most agreeable companion; easy, frank, and convivial; careless of money, even to a fault; always disposed to do kind offices; affectionate in his domestic relations, and greatly beloved by the numerous circle of his friends.

Lord Melville was twice married: first, to Miss Rannie, daughter of Captain Rannie of Melville, by whom he had one son, Robert, now Lord Melville; and three daughters. His second wife was Lady Jean Hope, sister of the late Earl of Hopetoun, by whom he left no issue.

Although not, strictly speaking, a literary man, Lord Melville is the author of several pamphlets on political subjects, which are distinguished by his usual sense and knowledge of business. These are, 1. *The Substance of a Speech in the House of Commons, on the British Government and Trade in the East Indies*, April 23, 1793. London, 1813, 8vo. 2. *Letter to the Chairman of the Court of Directors of the East India Company, upon an open Trade to India*. London, 1813, 8vo. 3. *Letters to the Right Honourable Spencer Percival, relative to the Establishment of a Naval Arsenal at Northfleet*. London, 1810, 4to.

DUNDEE, a seaport town in Forfarshire, situated on the north bank of the river Tay, about twelve miles from its mouth. It is forty-two miles from Edinburgh, twenty-two miles from Perth, and eighteen south-west from Arbroath, being in latitude 56. 2. 23. north, and longitude 3. 2. 55. west. The history of Scotland narrates many sackings and burnings of this town. The last of these was by General Monck; and such was its wealth at that time, that every soldier in Monck's army is said to have received L.60 sterling as his share of the plunder. Dundee was erected into a royal burgh by William the Lion in 1165. The town is governed by a provost, four bailies, a dean of guild, and thirteen councillors, and sends a member to parliament. In 1831 the government, at the solicitation of the inhabitants, granted them a resident sheriff-substitute. The market-place, or High Street, is a spacious square, 360 feet long by 100 broad, from which diverge the Nethergate, Seagate, Overgate, and Murraygate, the principal streets, which run from east to west, parallel to the river. These streets, till within the last forty years, formed the chief part of the town; and the access from it to the harbour being through narrow lanes, it had a very hampered and crowded appearance. This defect has been remedied by the opening up of several spacious streets

Dundee. leading from north to south, with houses built in a modern style. Castle Street leads from the south-east end of the High Street to the new docks on the south, and contains, among other neat buildings, an episcopal chapel and a theatre. At the south-east corner is an elegant building in the Grecian style, erected for an exchange and reading-room. On the south side of the market-place or square stands the town-hall, surmounted by a steeple, and having piazzas below; it was built in 1743. Opposite to this building is a spacious new street, named Reform Street; at the north end of which, and fronting the town-hall, an elegant edifice has lately been erected, in the Grecian style of architecture, for an academy and public schools. At the east end of the High Street, and rather obstructing the entrance to the Murraygate, stands the trades' hall, a plain edifice, with pilasters of the Ionic order, the principal apartment of which is used as a reading-room, and it contains, besides, apartments for each of the nine incorporated trades. A little to the west of the High Street is the Nethergate, a spacious and well-built street, in which are the remains of an old cathedral, containing four places of worship, one of which, the most entire, is built in the finest Gothic style, the groining of the arches being much admired. This structure is said to have been originally built by David earl of Huntingdon as far back as the year 1185. On the west end of these churches stands a magnificent Gothic tower 156 feet high. There are several other churches and chapels connected with the establishment, besides two episcopal chapels, and various other places of worship for dissenters, who form no inconsiderable part of the population. Among the public institutions may be mentioned a lunatic asylum, an infirmary, a dispensary for out-patients, and an orphan institution; a chamber of commerce, the society of writers, incorporated by royal charter, and a mechanics' institution. Dundee has four joint-stock banking establishments, viz. the Dundee Bank, the Union Bank, the New Bank, and the Commercial Bank. Besides these, there are agencies for the British Linen Company, the National Bank of Scotland, and the Bank of Scotland. There is a native establishment for fire insurance, and one for sea insurance. There are two weekly newspapers published in the place. The trade of Dundee has long been extensive, and it has rapidly increased of late years. Its manufactures are chiefly brown and bleached linens for the home and foreign market, great quantities of which are exported directly to North and South America. It also carries on a great trade to the Baltic, and has a number of vessels employed in the whale fishery. In the London trade, besides a number of sailing smacks, there are two splendid steam-vessels, having each two engines of 125 horse power. A railway was opened some years ago between Dundee and Newtyle, a village in Strathmore, about ten miles distant, which lays open the traffic of that extensive agricultural district. This undertaking has been attended with considerable expense, from the nature of the ground. It crosses the Law of Dundee, a high hill, by means of an inclined plane and tunnel, and the Siedlaw range of hills by an inclined plane at Balbeuchly. Two locomotive engines of ten horse power each are employed on it. The difficulties encountered in crossing the mountainous ridges being overcome, it is about to be extended to Coupar Angus, Glamis, Forfar, &c. Among the undertakings either in progress or in prospect may be mentioned a new jail and bridewell, a new custom-house, and an establishment for supplying water to the town. The tonnage of the port in 1832 amounted to 32,868 tons, which employed about 3500 seamen. Its imports in flax and hemp in 1832 amounted to 21,967 tons. There are in the town and neighbourhood about fifty spinning-mills, all worked by steam; and the steam

power employed in the different establishments exceeds 1400 horse power. There are several extensive iron foundries, and establishments for the manufacture of steam-engines and machinery. The grandest and most important feature, however, of Dundee is its harbour, upon which nearly L.200,000 has been expended. It consists of magnificent wet docks and a number of spacious quays, graving dock, &c. spreading along the margin of the Tay, and terminated on the west by the Craig Pier, which is exclusively appropriated to the use of the ferry, on which two twin steam-boats are employed, of a construction which admits of horses and carriages being transported across the river, which is here two miles broad, without unloosing the horses from the vehicles to which they are attached. The increase of the trade of Dundee within the last eighteen years has been in a greater ratio than that of any other place in the empire, if we except Liverpool and Glasgow, as will be seen from the following statement: In 1815 it had 157 vessels, registering 15,275 tons; in 1832 it had 274 vessels, registering 32,867 tons. In 1815 sixty-six vessels entered inwards with cargoes from foreign ports, registering 10,620; in 1832 there were 307 vessels, registering 46,539 tons, being an increase of 241 vessels, and four times the amount of tonnage. In 1815 three vessels cleared outwards with cargoes for foreign ports, registering 679 tons; in 1832, fifty-six vessels cleared outwards for foreign ports, registering 11,159 tons, being an increase of fifty-three vessels, and more than sixteen times the amount of tonnage. The population of Dundee in 1821 was 30,575, and by the census of 1831 it was 45,355, exclusive of the seamen belonging to the port. It is now understood to exceed 50,000. This town has become the principal seat of the linen trade of Great Britain, and the great emporium of flax and hemp.

DUNFERMLINE, a royal burgh of Scotland, situated in the western district of the county of Fife, fifteen miles north-west of Edinburgh, in longitude 3. 27. 11. west, latitude 56. 5. 3. north. The town is built on an extensive eminence, having a pretty steep and uniform declivity towards the south, and likewise declining into a ravine on the west, which divides the more ancient part of the town from the extensive and extending suburb of Pittencreeff. This ravine is crossed by an earthen mound, on which an excellent street has been built, which equals the second-rate streets of the metropolis, and exceeds in its uniformity, and the splendid appearance of its shops, the principal streets of most country towns. The town is situated about 270 feet above the level of the sea, and about two miles and a half distant from Limekilns, the nearest place on the coast. It may be described as consisting of one principal thoroughfare, stretching from east to west, near the top of the eminence on which the town is built, which is intersected at right angles by streets running up and down the hill, terminating in a plain both at the top and bottom. From its elevated situation, the prospect all around is very extensive. Seen from the south or west, the town has a very noble appearance, principally from its irregular outline, and the many prominent objects, such as steeples and public buildings, with which the whole is adorned; and it is here and there interspersed with gardens and trees, which give it a very pleasing and picturesque appearance, flanked as it is on the east and west by the extensive policies of Viewfield and Pittencreeff. The building most worthy of notice is the Abbey Church, which has been erected on the site of the Church of the Holy Trinity, built by Malcolm Ceanmore, about the middle of the eleventh century; which was demolished by Edward I. on the 10th February 1304, and subsequently at the Reformation, on the 28th of March 1560. However, at the latter period, the nave escaped

Dunfer-
line.

destruction, and was used as a place of worship till September 1821, when the new church was opened for divine service. It is a splendid edifice, in the most elegant Gothic style. Over the centre of the cross is erected a square tower ninety feet high, terminating in a flat roof, round the four sides of which, in open hewn work, are the words "King Robert the Bruce," in capital letters four feet in height, surmounted by royal crowns and lofty pinnacles on the four corners, which give an elegant and appropriate finish to the whole. The old church forms a very fine entrance to the new; and, were a little expense laid out in some small repairs, it might be rendered still more impressive. It is of various orders of architecture, accordant with the different ages in which it has been altered and repaired. The interior of the new Abbey Church is even more elegant than its exterior. Its tower and galleries are supported by magnificent pillars, moulded on the solid mason-work with Roman cement, into small columns, which form the aggregate pillar, the capitals of which are adorned with exquisite imitations of foliage. The ribs of the arches composing the different roofs and the central ornaments are in the purest style, and, seen from any point, the effect of the whole is at once magnificent and pleasing. Exactly below the pulpit, which is of wainscot, and in the Gothic style, lie the remains of Robert Bruce; and in the north transept lie seven other kings, two queens, and numbers of the nobility. Besides the old church, all that now remains of the ancient buildings is the south-west wall of the palace, which hangs on the brink of a deep hollow, through which runs a small stream. A building over a gate, probably the principal entrance to the palace yard, the south wall of the Refectory or Fraters Hall, and a large window of elegant workmanship, form the whole antiquities of the abbey and palace. There is likewise some slight traces of Malcolm Ceanmore's tower, which formed the original nucleus of the town. The Guildhall, which was erected in 1808, is a superb edifice of the Grecian order, having a spire a hundred and thirty-two feet in height. It consists of a large hall intended for meetings of guildry; the chamber is occupied as a reading-room, and the rest of the building is fitted up as a hotel. The town-house is a narrow building, with a prison above. The council hall is adorned with some good paintings, and the whole is surmounted by a spire. The Bank of Scotland is an elegant building in the Abbey Park, surrounded with an extensive policy. The High School is a beautiful building in the Grecian style, and is taught by a rector and usher; the Commercial Academy is in the form of a villa, where the several branches of education are taught by two independent teachers, with assistants. A handsome new row of houses has been erected at the eastern entrance to the town.

The linen trade is of considerable antiquity in Dunferline; it began originally with ticks and checks. The first table-linen manufactured here was a kind called huckabuck; this was followed in course of time by damask, the richest and most ingenious kind of table-linen, which has been for the last century improving in quality and pattern, and is still continuing to be improved. The value of table-linens and covers annually manufactured here is estimated at about L.200,000. Another important branch of industry is the spinning of yarns and threads; there are eight large spinning mills, at some of which the very finest quality of yarns is manufactured.

This town is remarkable as being the theatre in which the principal dissents from the established church have taken their rise; namely, the Seceders under Ralph Erskine, and the Relief under George Gillespie.

The population of the parish in 1821 was 13,690, and of

the town 8041; in 1831 the former was 17,068, and the latter 10,624.

DUNGALLY, a town on the western coast of the island of Celebes, situated on the south point of land which forms one side of Parlow Bay, which affords good anchorage. It is defended by a fort, and carries on a considerable trade.

DUNGANNON, a town of Ireland, in the county of Tyrone, situated on a hill. It is of some extent, and contains a charter school liberally endowed, also barracks for a troop of horse. This place is said to have been the chief residence of the O'Neils, monarchs of Ulster. There are coal mines in the neighbourhood of the town. It lies seventy-two miles north-west of Dublin. The population amounts to 3515.

DUNGARVON, a town of Ireland, in the county of Waterford, situated on the south side of a bay of the same name. The principal article of export is potatoes. This place is much resorted to in summer for sea-bathing. It lies twenty-two miles west-south-west of Waterford, and a hundred miles south-south-west of Dublin. The population amounts to 6519.

DUNGYE, a town of Hindustan, province of Bahar, district of Shahabad, sixty-eight miles south-west from Patna. Long. 84. 17. E. Lat. 24. 55. N.

DUNKELD, a town of Scotland, in the county of Perth, situated on the northern bank of the river Tay, in a truly romantic spot, embosomed among lofty crags, now almost wholly covered with wood. It is the chief market-town of the Central Highlands. The immediate vicinity has been greatly improved by the Dukes of Atholl, particularly by the last, under whom much was done not merely to beautify his own residence, but also to enrich the scenery which encloses Dunkeld, particularly on the north. He also commenced building a new mansion, or rather palace, on an extensive and magnificent scale; but the building was interrupted by his death, and has not yet, it seems, been resumed.

Dunkeld is of great antiquity. It was the capital of ancient Caledonia. About the dawn of Christianity, a Pictish king made it the seat of religion, by erecting there a monastery of Culdees, which king David I., in 1130, converted into a cathedral, and it ranked as the first in Scotland. Since the Reformation it has in a great measure fallen into ruins. The choir, however, is still entire, and converted into the parish church, which has of late been very elegantly fitted up. On the north side of the choir is the charter-house, built by Bishop Lauder in 1469, the vault of which is now used as the burying-place of the Atholl family. In the porch of the present church is the tomb of Alexander Stuart, earl of Buchan, third son of Robert II., but better known by the name of *The Wolfe of Badenoch*, who died in 1394. The seat of the Atholl family, when the new building is completed, will be one of the finest in the kingdom. There is, almost right opposite, a cascade, on the water of Bran, which, in its way from the western hills, forms a considerable fall called the *Rumbling Brig*, from a narrow bridge made by the fall of two rocks across the stream. The pencil of Rosa never delineated a wilder or more striking scene. The stream has a second fall, which, but for the other, would be deemed superb. Sir James Galloway, master of requests to James VI. and to Charles I. was created Lord Dunkeld in 1645; but his grandson James was attainted at the Revolution, and having died at the beginning of last century, the title became extinct. Besides the parish church, there are two dissenting meeting-houses in Dunkeld. The village has five fairs annually. The population amounted in 1821 to 1915, and in 1831 to 1471.

DUNKIRK, an arrondissement of the department of the

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Dunkirk.

Dunkirk North, in France, extending over 310 square miles, divided into seven cantons, and these subdivided into fifty-nine communes, containing 86,580 inhabitants.

DUNKIRK, a city in the department of the North, in France, at the end of a harbour which is nearly dry at low water. It was formerly more flourishing than it is at present, and once created such apprehensions on the part of England, that in several treaties the demolition of the fortifications was stipulated. It now contains 1800 houses and 24,600 inhabitants. There are still the rudiments of a naval arsenal; and it has some trade, and shipping employed in the whale fishery.

DUNMOW, GREAT, a market-town of the hundred of the same name, in the county of Essex, thirty-seven miles from London, and situated on the river Roding. It is a town of very ancient date, supposed to be the Cæsaromagus of the Romans, and where remains of the road to Colchester, constructed by that people, are still visible. It is governed by a corporation. The market is held on Saturday. The inhabitants amounted in 1801 to 1828, in 1811 to 2015, in 1821 to 2409, and in 1831 to 2462. Near to it is Little Dunmow, remarkable for the ancient right which a happy couple have to demand a fitch of bacon at the end of a year from their marriage.

DUNNING, JOHN, LORD ASHBURTON, a celebrated English counsellor, was the second son of Mr John Dunning of Ashburton, Devonshire, an attorney. He was born at Ashburton, on the 18th of October 1731, and was educated at the free grammar school of his native place, where he soon distinguished himself by his proficiency in classical literature as well as the mathematics. On leaving school he was taken into his father's office, where he remained until the age of nineteen, when he was sent to the Temple. After he came to the bar he got very slowly into practice. In the year 1762 he was employed to draw up *A Defence of the United Company of Merchants of England trading to the East Indies, and their Servants, particularly those at Bengal, against the Complaints of the Dutch East India Company to his Majesty on that subject*; which was considered as a masterpiece of language and reasoning, and from which he derived not only immediate profit, but such a large share of reputation as secured him extensive practice in his profession.

In 1763 he distinguished himself as counsel in the memorable proceedings in the case of Wilkes, and his professional business, from that period, gradually increased to such an extent that, in 1776, he is said to have been in the receipt of nearly L.10,000 per annum. In 1766 he was chosen recorder of Bristol, and on the 23d of December 1767 he was appointed to the office of solicitor-general, which he held until the month of May 1770, when he retired, along with his friend Lord Shelburne. In 1771 he was presented with the freedom of the city of London. From this period he was considered as a regular member of the opposition party, and distinguished himself by many able speeches in parliament. He was first chosen member for Calne in 1768, and continued to represent that borough until he was promoted to the peerage. In 1782, when the Marquis of Rockingham became prime minister, Mr Dunning was appointed chancellor of the duchy of Lancaster; and about the same time he was advanced to the peerage, by the title of Lord Ashburton. He died while on a visit to Exmouth, on the 18th of August 1783.

The person of Lord Ashburton was by no means agreeable or prepossessing. He was a short, thick man, with a sallow countenance, a constant shake of the head, and a

hectic cough, which frequently interrupted the stream of his eloquence. His oratory, however, was at once fluent, elegant, and argumentative, and he possessed a sound knowledge of the laws, and of the theory of our constitution. His language was pure and classical, yet peculiar to himself, and he had a great fund of wit and humour. His disposition was originally timid, but this defect he overcame by practice, as he became more familiar with forensic habits. Of the great extent of his practice some notion may be formed from the fortune he left behind him, which was all earned by his own exertions, and amounted to no less a sum than L.180,000.

Sir William Jones has pronounced a splendid eulogium on the character of Lord Ashburton. "His language," says that accomplished scholar, "was always pure, always elegant; and the best words dropped easily from his lips into the best places, with a fluency at all times astonishing, and, when he had perfect health, really melodious. His style of speaking consisted of all the turns, oppositions, and figures, which the old rhetoricians taught, and which Cicero frequently practised, but which the austere and solemn spirit of Demosthenes refused to adopt from his first master, and seldom admitted into his orations, political or forensic. That faculty, however, in which no mortal ever surpassed him, and which all found irresistible, was his wit. This relieved the weary, calmed the resentful, and animated the drowsy; this drew smiles even from such as were the objects of it; scattered flowers over a desert; and, like sun-beams sparkling on a lake, gave spirit and vivacity to the dullest and least interesting cause. He was endued with an intellect sedate yet penetrating, clear yet profound, subtle yet strong. His knowledge, too, was equal to his imagination, and his memory to his knowledge."

Besides the *Answer to the Dutch Memorial*, Lord Ashburton is supposed to have assisted in writing a pamphlet on the law of libel, and to have been the author of *A Letter to the Proprietors of East India Stock, on the subject of Lord Clive's Jaghire, occasioned by his Lordship's Letter on that Subject*, 1764, 8vo. His lordship was at one time suspected of being the author of the celebrated *Letters of Junius*. (See Chalmers's *Biog. Dict.*, and Sir W. Jones's *Works*, vol. iv.)

DUNS, JOHN, a schoolman of the highest reputation, is said to have been born in the year 1274, but the place of his birth has been long and much disputed. Dempster has asserted the claims of Scotland by twelve arguments;¹ but a less formidable number might perhaps have been sufficient. The designation *Scotus*, which is commonly added to his name, evinces him to have been a native either of Scotland or of Ireland; and the pretensions of the latter country cannot be supported by the authority of a single early writer. Wadding and other Irish authors who claim him as their countryman, persuade themselves that he was born at *Dunum*, or Downpatrick, and must thence have derived the name of Duns;² but this is obviously a mere conjecture, unsupported by tradition, and carrying with it no great plausibility. Leland claims him as an Englishman, on the authority of certain manuscript copies of his works, preserved in the library of Merton College, and bearing a colophon which describes him as born at the village of Dunstane in the county of Northumberland.³ But if this had been the place of his birth, his surname ought to have been Dunstane. It apparently belongs to the class of local surnames, or those derived from places of birth or habitation; and we have little or no hesitation in supposing him

¹ Dempsteri Asserti Scotiæ Cives esse sui; S. Bonifacius rationibus ix. Joannes Duns rationibus xii. Bononiæ, 1621, 4to.

² Wadding Scriptorum Ordinis Minorum, f. 201. a. Romæ, 1650, fol.

³ Lelandus de Scriptoribus Britannicis, tom. ii. p. 317.

Dunse.

to have been a native of Dunse in the county of Berwick. This surname is still to be found in Scotland. He is mentioned as a native of Scotland by Trithemius,¹ and likewise by Paulus Jovius, Sixtus Senensis, Possevin, and many other writers of various countries. We are told that when a boy he became accidentally known to two Franciscan friars, who, finding him to be a youth of very extraordinary capacity, took him to their convent at Newcastle, and afterwards persuaded him to become one of their fraternity. From thence he was sent to Oxford, where he became a fellow of Merton College, and professor of divinity; but it appears that he had likewise studied at Paris. His lectures were frequented by a prodigious concourse of students. His fame was now become so universal, that the general of his order removed him to Paris, that the students of that university might also have the benefit of his lectures. He went to Paris in the year 1304, where he is said to have been honoured first with the degree of bachelor, then of doctor of divinity, and in 1307 to have been appointed regent of the divinity schools; but as he had taught divinity at Oxford, he must previously have taken at least one degree in that faculty. During his residence at Paris, arose the famous controversy about the immaculate conception of the Virgin Mary. Albertus Magnus maintained that she was born in original sin. Scotus advanced two hundred arguments in support of the contrary opinion, and convinced the university of Paris that she was really conceived immaculate. This important nonsense however continued to be disputed till the year 1496, after the council of Basel, when the university of Paris made a decree, that no student who did not believe the immaculate conception should be admitted to a degree. Duns had not been above a year at Paris, when the same general of the Franciscans ordered him to remove to Cologne, where he was received with great pomp and ceremony by the magistrates and nobles of that city, and where he died of an apoplexy soon after his arrival, in the year 1308, in the thirty-fourth year of his age. Some writers have reported that he was buried in an epileptic fit, and that, upon removing his bones, he appeared to have turned himself in his coffin. The genius of this renowned schoolman, who obtained the appellation of *Doctor Subtilis*, or the Subtle Doctor, reflects no inconsiderable lustre on the nation to which he belonged: he maintained a reputation almost unrivalled till the scholastic theology and scholastic philosophy were finally exploded. His followers, who were called Scotists, opposed the opinions of the Thomists, or followers of St Thomas Aquinas. An edition of his works, accompanied by a life of the author by Luke Wadding, was published at Lyon in twelve volumes folio.

DUNSE, a market-town of Scotland, in the district of Merse, Berwickshire. It is situated on a rising ground in the middle of the shire, and though not the county town, is by far the largest and most respectable place in Berwickshire. It is a burgh of barony, and is governed by a bailie. The town is of great antiquity, and was frequently destroyed in the Border wars. As seen from any point around, Dunse has the appearance of a city, and on closer inspection it is found to possess a respectable proportion of good houses. In the market-place stands the town-house, an elegant modern building, in the Gothic style. Besides a parish church, Dunse possesses two Seceder meeting-houses and a Relief chapel. There is here a weekly market, and four fairs for sheep and three for horses and cattle annually. Dunse is considered as the birthplace of the famous John Duns Scotus. A mile south of the town is a well of mineral water, which is a powerful chaly-

beate. The population in 1821 amounted to 3773, and in 1831 to 3469.

DUNSTABLE, a market-town in the hundred of Manshead, in the county of Bedford, thirty-three miles from London. This neighbourhood was celebrated formerly for the size of its larks, and for the great number of straw and chip hats made by the females, a trade which is still extensively carried on. It was a Roman station, the *Mageovinium* of Antoninus. There is here a weekly market, which is held on Saturday. The inhabitants amounted in 1801 to 1296, in 1811 to 1616, in 1821 to 1831, and in 1831 to 2117.

DUNSTAN, SAINT, a famous archbishop of Canterbury. He was descended from a noble family in Wessex, and educated in the abbey of Glastonbury, where he studied so hard that it threw him into a violent fever, which brought him to the very point of death. When the whole family were standing about his bed, dissolved in tears, and expecting every moment to see him expire, an angel came from heaven in a dreadful storm, and gave him a medicine which restored him to perfect health in a moment. Dunstan immediately started from his bed, and ran with all his speed towards the church to return thanks for his recovery; but the devil met him by the way, surrounded by a great multitude of black dogs, and endeavoured to obstruct his passage. This would have frightened ordinary boys, but it had no effect whatever upon Dunstan, who, having pronounced a sacred name, and brandished his stick, put the devil and all his dogs to flight. The church doors being shut, an angel took him up in his arms, conveyed him through an opening in the roof, and set him softly down on the floor, where he performed his devotions. After his recovery, he pursued his studies with the greatest ardour, and soon became a perfect master in philosophy, divinity, and music; painting, writing, and sculpture; besides working in gold, silver, brass, iron, and other metals. Whilst still young he entered into holy orders, and was introduced by his uncle Athelm, archbishop of Canterbury, to King Athelstan, who, being charmed with his person and accomplishments, retained him at his court, and employed him in many great affairs. At leisure hours he used to entertain the king and his courtiers with playing on the harp, or some other musical instrument; and now and then, by way of variety, he wrought a miracle, which gained him great admiration. But his old enemy the devil was much offended at this, and prompted some envious courtiers to persuade the king that his favourite was a magician; a story which that prince too readily believed. Dunstan, however, having discovered by the king's countenance that he had lost his favour, resolved to resign rather than be turned out, and accordingly retired from court to another uncle, who was Bishop of Winchester. This good prelate prevailed upon his nephew to forsake the world and become a monk; after which he retired to a little cell built against the church wall of Glastonbury. Here he slept, studied, prayed, meditated, and sometimes amused himself with forging several useful things in brass and in iron. One evening as he was working very busily at his forge, the devil, putting on the appearance of a man, thrust his head in at the window of his cell, and asked him to make something or other for him. Dunstan was so intent upon his work that he made no answer, upon which the devil began to swear and to talk obscenely. This betrayed the lurking fiend. But the holy blacksmith was prepared for all casualties; so putting up a secret ejaculation, he pulled his tongs, which were red hot, out of the fire, and seizing the devil by the nose, squeezed the Satanic

¹ Trithemius de Scriptoribus Ecclesiasticis, f. 76. a. Basil. 1494, fol.

Dunstan. organ of smell with a degree of energy which caused his infernal majesty to bellow and scold at such a rate that he awakened and terrified all the people for many miles around. Thus far the monkish legend.

However ridiculous these fictions may seem, they served, in those times of ignorance, to procure Dunstan a reputation which has been confirmed by the authority of several succeeding historians. It appears that this extraordinary person was called to court in 941, by King Edmund, who bestowed upon him the rich abbey of Glastonbury, which for his sake he honoured with many peculiar privileges. Dunstan enjoyed in a very high degree the favour of this prince during his short reign of six years; but he stood much higher in the grace of his brother and successor King Edred, to whom he was confessor, chief confidant, and prime minister. During this period of court favour he employed all his influence in promoting the interest of the monks of the Benedictine order, to which he belonged, and of which he was a most active and zealous patron. Having the treasures of these two princes, especially of the last, at his command, he lavished them away in building and endowing monasteries for these monks, because almost all the old monasteries were in the possession of secular canons; and not contented with this, he persuaded Edred, who was a bigoted valetudinary, to bestow, by his last will, such immense treasures on the churches and monasteries, that the crown was stripped of its most valuable possessions, and left in a state of indigence. This conduct of Dunstan, whilst he was in power, rendered him very odious to Edwy, who succeeded his uncle Edred in 955; and his rude behaviour to the king himself, and his beloved queen Elgiva, raised the resentment of that prince to such a height that he deprived Dunstan of all his preferments, and drove him into exile. The banishment of Dunstan, the great patron, or, as Malmsbury calls him, the prince of monks, was a severe blow to that order, who were in consequence expelled from several monasteries. But their sufferings were not of long continuance; for Edgar, the younger brother of Edwy, having raised a successful rebellion against his brother, and usurped all his dominions on the north side of the Thames, recalled Dunstan, and in 957 conferred on him the bishopric of Worcester. From this moment he was the chief confidant and prime minister of King Edgar, who in 959 became sole monarch of England, by the death of his elder brother Edwy. In the following year Dunstan was raised to the archiepiscopal see of Canterbury; and being thus possessed of the primacy and assured of the royal support and assistance, he prepared to execute the grand design which he had long meditated, of compelling the secular canons to put away their wives and become monks, or, in case of resistance on their part, of driving them out, and introducing Benedictine monks in their stead. With this view he procured the promotion of Oswald to the see of Worcester, and of Ethelwald to that of Winchester, two prelates who were monks themselves, and animated with the most ardent zeal for the advancement of their order; and these three great champions of monachism found means, by their arts and intrigues, in the course of a few years, to fill no fewer than forty-eight monasteries with Benedictines. But on the death of Edgar in 975 they received a check. The sufferings of the persecuted canons had excited much compassion, and many of the nobility, who had been overawed by the power and zeal of the late king, now espoused their cause and promoted their restoration. Elferc duke of Mercia drove the monks by force out of all the monasteries in that extensive province, and brought back the canons, with their wives and children; whilst Elfwin duke of East Anglia, and Brithnot duke of Essex, raised troops to protect the monks in these countries. In order to al-

lay these commotions, several councils were summoned, and Dunstan was so hard pushed by the secular canons and their friends, that he was obliged to practise some of his holy stratagems; but finally, by dint of miracles, he overcame all opposition.

St Dunstan died in 988, in the sixty-fourth year of his age, having held the bishopric of London, together with the archbishopric of Canterbury, about twenty-seven years. As this prelate was the great restorer and promoter of the monastic institutions, the grateful monks, who were almost the only historians of those dark ages, have loaded him with the most extravagant praises, and represented him as the greatest wonder-worker and highest favourite of heaven that ever lived.

DUNSTER, a borough-town in the hundred of Carhampton, in Somersetshire, 163 miles from London. It is situated in a beautiful vale at the foot of the Quatoch Hills, about one mile from the Bristol Channel. It has ceased to send members to parliament for many years. The market is held on Friday. The inhabitants amounted in 1801 to 772, in 1811 to 868, in 1821 to 895, and in 1831 to 983.

DUNTEEWARAH, a town of Hindustan, belonging to independent chiefs, in the province of Gujerat. Long. 72. 45. E. Lat. 24. 55. N.

DUNUM, a Celtic term, denoting a hill or eminence, and often concurring to form the names of towns, as well as to indicate their elevated situation as places of strength or citadels; hills or eminences being adapted to such structures. See **DUN**.

DUNWICH, a small borough-town of the hundred of Blything, in Suffolk, once a city, and remarkable only from having sent two members to parliament, but it is now disfranchised. The inhabitants amounted in 1801 to 184, in 1811 to 208, in 1821 to 200, and in 1831 to 232.

DUPIN, **LOUIS ELLIES**, doctor of the Sorbonne, and professor of philosophy in the Royal College, one of the greatest critics of his time, especially in ecclesiastical matters, was born at Paris in 1657. When he published the first volume of his *Bibliothèque Universelle des Auteurs Ecclésiastiques*, in 1686, the liberty with which he treated some ecclesiastical writers gave so much offence that M. de Harlay, archbishop of Paris, obliged Dupin to retract many of his propositions, and besides suppressed the work. Nevertheless he was suffered to continue it, by altering the title from *Bibliothèque Universelle* to *Bibliothèque Nouvelle*. This great undertaking, continued in successive volumes till it reached as many as fifty-eight, though sufficient to occupy the life of an ordinary man, did not prevent M. Dupin from obliging the world with other works. He was a man of prodigious reading, and had an easy, happy way of writing, with an uncommon talent for analyzing the works of an author; a quality which renders his *Bibliothèque* so valuable. M. Dupin was banished for a time from his chair in the Royal College, to Chatelherault, on account of the famous *Cas de Conscience*, but he was afterwards restored, and died in 1719.

DUPINASCHA, a city of Turkey in Europe, in the province of Kostendill. It stands at the foot of a mountain of its own name, which is watered by the Isker, and contains about 6000 inhabitants, chiefly employed in the iron mines of the mountains near them.

DUPLE, among mathematicians, denotes the ratio of 2 to 1. Thus the ratio of 8 to 4 is duple, or as 2 to 1.

Sub-duple ratio is just the reverse of the former, or as 1 to 2. Thus the ratio of 4 to 8, or 6 to 12, is sub-duple, or as 1 to 2.

DUPLICATE, among lawyers, denotes a copy of any deed, writing, or account. It is also used for the second

Dunster
Duplicate.

Duplica-
tion
||
Dupuis.

letters-patent granted by the Lord Chancellor in a case wherein he had done the same before. A second letter written and sent to the same party, and of the same tenor as a former one, from fear of the first miscarrying, is called a *duplicate*.

DUPLICATION, in general, signifies the doubling of any thing, or multiplying it by 2; also the folding of any thing back again on itself.

DUPLICATURE, among anatomists, is a term used to denote the folds of any membrane or vessel. Thus we say the *duplicatures of the intestines, peritonæum*, and the like.

DUPONDIUS, in *Antiquity*, a weight of two pounds, or money of the value of two asses. See *As*.

Since the as at first weighed a pondo or libra, the dupondius must have weighed two; and hence the name. Though the weight of the as was afterwards diminished, and consequently that of the dupondius, yet they still retained the denomination. See *POUND* and *LIBRA*.

DUPPA, BRIAN, a learned English bishop, was born in 1589, at Lewisham, in Kent, of which place his father was then vicar. In 1634 he was constituted chancellor of the church at Sarum, and soon afterwards made chaplain to Charles I. He was appointed tutor to Charles prince of Wales, and his brother James duke of York; and about the same time nominated to the bishopric of Chichester. In 1641 he was translated to the see of Salisbury, but received no benefit from this preferment, owing to the suppression of episcopacy. Charles I. held him in high esteem, and is said to have derived assistance from him in composing the *Εἰκὼν Βασιλική*. After the restoration he was made bishop of Winchester, and lord high almoner. He died at Richmond in 1662, aged seventy-three.

DUPPAU, or DAUPOW, a town in the circle of Ellbogen, in the Austrian kingdom of Bohemia. It is situated in a vale watered by the river Aboche, and has a castle, a monastery, and about 1200 inhabitants, chiefly employed in the cloth manufacture.

DUPUIS, CHARLES FRANCIS, an eminent French writer, and member of the Institute, was born of poor parents, at Tryé-Château, between Gisors and Chaumont, on the 26th of October 1742. His father, who was a teacher, instructed him in mathematics and land-surveying. The Duke de la Rochefoucault, who accidentally became acquainted with the youth, took him under his protection, and gave him a bursary or exhibition in the College of Harcourt.

Dupuis made such rapid progress in his studies, that, at the age of twenty-four, he was appointed professor of rhetoric at the college of Lisieux. In his hours of leisure he applied himself to the study of the law, and on the 11th of August 1770 he was admitted an advocate before the parliament. He was charged by the rector of the university with the task of delivering the customary discourse at the distribution of prizes; and he was also employed in the name of the university to compose the funeral oration of the Empress Maria Theresa of Austria. These two works having been printed, were admired on account of their elegant latinity, and laid the foundation of the author's fame as a writer.

The mathematics having been the object of his early studies, he now devoted his more serious attention to that science; and for some years he attended the astronomical lectures of Lalande, with whom he formed an intimate friendship. In 1778 he constructed a telegraph on the principle suggested by Amontons; and he succeeded so well, that he was enabled to correspond with his friend M. Fortin, who, from the village of Bagneux, where he had a country seat, observed with a telescope the signals made by Dupuis at Belleville, and returned his answer on

the following day. In this manner they continued to correspond every year, during the fine season, from 1778 to the commencement of the Revolution. Dupuis then destroyed his machine, lest it should render him suspected in those dangerous times.

Much about the same time, Dupuis formed his ingenious theory with respect to the origin of the Greek months. In the course of his investigations upon this subject, he composed a long memoir on the constellations. He had been struck with the singularity of the figures by which the groups of stars called constellations were represented on the most ancient planispheres; and had also remarked that these groups did not present to the eye any form analogous to their representations. Hence he concluded, that the real configurations of these constellations, or asterisms, could not have been the origin of the figures and of the names which had been given to them from the highest antiquity. Dupuis attempted to resolve this enigma, in so far at least as related to the constellations of the zodiac. He conceived that this representation of the heavens during the course of the year must have some reference to the state of the earth, and to the labours of agriculture at the time, and in the country, in which these signs had been invented; so that the zodiac was, for the people who invented it, a sort of calendar at once astronomical and rural. It seemed only necessary, therefore, to discover the clime and the period in which the constellation of *Capricorn* must have arisen with the sun on the day of the summer solstice, and the vernal equinox must have occurred under *Libra*. It appeared to Dupuis that this clime was Egypt, and that the perfect correspondence between the signs and their significations had existed in that country for a period of between fifteen and sixteen thousand years before the present time; that it had existed only there; and that this harmony had been disturbed by the effect of the precession of the equinoxes. He therefore ascribed the invention of the signs of the zodiac to the people who then inhabited Upper Egypt or Ethiopia. This was the basis on which Dupuis established his mythological system, and endeavoured to explain the curious subject of fabulous history, and the whole system of the theogony and theology of the ancients.

Persuaded of the importance of his discoveries, which, however, were by no means entirely original, Dupuis published several detached parts of his system in the *Journal des Savants* for the months of June, October, and December 1777, and of February 1781, which he afterwards collected and published, first in Lalande's *Astronomy*, and then in a separate volume in 4to, 1781, under the title of *Memoire sur l'Origine des Constellations, et sur l'Explication de la Fable par l'Astronomie*. The theory propounded in this memoir was refuted by M. Bailly, in the fifth volume of his *History of Astronomy*; but, at the same time, with a just acknowledgment of the erudition and ingenuity exhibited by the author.

Condorcet proposed Dupuis to Frederick the Great of Prussia as a fit person to succeed Thiebault in the professorship of literature at Berlin; and Dupuis had accepted the invitation, when the death of the king put an end to the engagement. The chair of humanity in the college of France having at the same time become vacant by the death of M. Bejot, it was conferred on Dupuis; and in 1788 he became a member of the Academy of Inscriptions. He now resigned his professorship at Lisieux, and was appointed by the administrators of the department of Paris one of the four commissioners of public instruction.

At the commencement of the revolutionary troubles Dupuis sought an asylum at Evreux; and having been chosen a member of the national convention by the de-

Dupuis.

Duquella ||
Durandus. department of the Seine and Oise, he distinguished himself by the moderation of his speeches and public conduct. In the third year of the republic he was elected secretary to the assembly, and in the fourth he was chosen a member of the council of Five Hundred. After the memorable 18th of *Brumaire* he was elected by the department of the Seine and Oise a member of the legislative body, of which he became the president. He was afterwards proposed as a candidate for the senate; and here terminated his political career.

In 1794 he published his large work, entitled *Origine de tous les Cultes, ou la Religion Universelle*, 3 vols. 4to, with an atlas, or 12 vols. 12mo. This work excited considerable sensation at first; it gave umbrage to many, was attacked and defended with warmth, at length ceased to be read, and fell into utter neglect. In 1798 he published an abridgment of this work in one volume 8vo, which met with no better success. Another abridgment of the same work, executed upon a much more methodical plan, was published by M. de Tracy. The other works of Dupuis consist of two memoirs on the *Pelasgi*, inserted in the *Memoirs of the Institute*; a memoir *On the Zodiac of Tentyra*, published in the *Revue Philosophique* for the month of May 1806; and a *Mémoire Explicatif du Zodiaque Chronologique et Mythologique*, published the same year, in one volume 4to. It was from the perusal of the poem of *Nonnus*, which he once thought of translating into French, and of which a fragment was printed in the *Nouvel Almanach des Muses* for the year 1805, that Dupuis caught the first idea of his astronomical system.

Dupuis died at Is-sur-Til, on the 29th of September 1809, leaving behind him several manuscripts on subjects connected with the works which he had published during his life. He was a member of the legion of honour; and his character was that of an honest man and a paradoxical writer. He was born poor, and never acquired any fortune. M. Dacier, secretary to the third class of the Institute, delivered his *Eloge*; and an historical account of his life and writings was published by his widow. (See also *Biographie Universelle*.)

DUQUELLA, a province of Morocco, about seventy-five miles long and sixty broad. It is chiefly remarkable in an agricultural point of view for the production of a species of water melon, which grows to a prodigious size. Grain is also raised, but not in such quantities as in some other parts of the empire. Goats are bred in immense numbers, and their skins form one of the principal articles of export from Mogadore. Honey and wax are in great abundance. The inhabitants are industrious, and much inclined to commerce.

DURADSCH, the ancient Dyrrachium, a sea-port in Greece, in the country of the Arnauts. It is the see of a Greek archbishop and of a Catholic bishop, is fortified, and contains 5000 inhabitants. There is a good harbour, whence both commerce and piracy have long been carried on. The air is most unwholesome.

DURAKAH, a small island in the Red Sea, about sixteen miles from the coast of Arabia. Long. 41. 31. E. Lat. 16. 48. N.

DURANDUS, WILLIAM, one of the most learned lawyers of the thirteenth century, was born at Puimoisson, in Provence. He was a pupil of Henry of Susa, and taught canon law at Modena. He was afterwards made chaplain and auditor of the sacred palace, legate of Gregory X. at the council of Lyons, and bishop of Mende in 1286. His works are, 1. *Speculum Juris*, Rome, 1474,

folio, whence he derived the name of *Speculator*; 2. *Rationale Divinorum Officiorum*, Mentz, 1459, folio, scarce; 3. *Repertorium Juris*, Venice, 1496, folio.

DURANGO, a town of Spain, in the province of Biscay. It stands twenty miles south-east of Bilboa, on one of those numerous streams which, when united, form its river. It contains 2800 inhabitants. Manufactories of iron and steel goods are carried on here.

DURANGO, or **NEW BISCAY**, an intendancy of Mexico, in North America. According to Humboldt, it extends from long. 104. 40. to 110. 0. W. and from lat. 23. 55. to 29. 5. N.¹ It is bounded on the west by Sonora; on the east it touches on San Luis Potosi; and towards the north and east, for upwards of 200 leagues, it borders on an uncultivated country, inhabited by warlike and independent Indians. It comprehends the northern extremity of the great table-land of Anahuac. Its length from north to south, from the celebrated mines of Guarisamey to the mountains of Carçay, is 232 leagues. Its breadth is very unequal, and near Parrel is scarcely fifty-eight leagues. Its extent of surface is greater than that of the united kingdom of Great Britain and Ireland; and yet its total population, according to Humboldt, was in 1803 rather less than 160,000. Of these, Major Pike thinks, three twentieths might be European whites, five twentieths Creoles, five twentieths Mestizoes and half-castes, and seven twentieths Indians. It comprises, besides the city of Durango, six towns (villas), 199 villages (pueblos), seventy-five parishes (paroquias), 152 haciencias, thirty-seven missions, and 400 cottages (ranchos).

The climate of this intendancy is stated by Major Pike to be dry, and the heat, at that period of the year which precedes the rainy season, to be very great. The rains commence in June, and continue by light showers till September. During the remainder of the year there falls neither rain nor snow to moisten the earth, and the atmosphere becomes highly electrified. The agricultural produce consists of wheat, maize, rice, oats, cotton, flax, indigo, and the fruit of the vine. To the north of Chihuahua, about thirty miles to the right of the main road, there is some pine timber. In one place, near a spring, Major Pike noticed a solitary walnut tree; and in all the small streams there are, he says, shrubby cotton trees. "With these few exceptions, the whole province is a naked, barren plain, which presents to the eye an arid unproductive soil; and, more especially in the neighbourhood of mines, even the herbage appears to be poisoned by the qualities of the land." New Biscay trades with the southern provinces, and also with New Mexico and Sonora, furnishing to the more populous parts of the kingdom a great number of horses, mules, beeves, sheep, and goats, in return for dry goods, European furniture, ammunition, books, and other articles, which are brought from the capital on mules. "Some individuals make large fortunes by being the carriers, from Mexico to Chihuahua, the freight being eight dollars per cent.; and they generally put 300 lb. on each mule. The merchants make their remittances twice a year, in bullion. Goods sell at Chihuahua about 200 per cent. higher than the prices in the sea-port towns of the Atlantic. This was in 1807. Horses then averaged six dollars; some, however, fetched a hundred dollars; and trained mules twenty dollars. Rice sold for four dollars the hundredweight. They manufacture some few arms, blankets, stamped leather, embroidery, coarse cotton and woollen cloths, and a species of carpeting." This traveller concludes his statistical account of

¹ According to Major Pike, a more recent traveller in these parts, it is situated between long. 105. and 111. W. and lat. 24. and 33. N. He gives its length from north-west to south-east at 600 miles, its greatest breadth at 400, and its population at 200,000.

Durango. the province by stating, that law here is merely a shadow, the only laws that can be said to be in force being the military and the ecclesiastical; that the corruption of morals is general, this being the natural concomitant of a great degree of luxury among the rich, and of misery among the poor; and that the Roman Catholic religion is in full force, but the inferior clergy are much dissatisfied.

There are no slaves in this province, nor, according to Humboldt, a single tributary individual; and "all the inhabitants, are either white, or consider themselves as such." Major Pike explains the state of things more specifically. Except the Apadus, who inhabit the Bolson de Mapimi, there are, he says, no uncivilized tribes in this province. "The Christian Indians are so incorporated amongst the lower grades of Mestizoes, that it is scarcely possible to draw the line of distinction, except at the ranchos of some nobleman or large landholder, where they are in a state of vassalage. This class of people laid a conspiracy, which was so well concerted as to baffle the research of the Spaniards for a length of time, and to occasion them the loss of several hundreds of the inhabitants. The Indians used to go out from their villages in small parties; in a short time a part would return with a report that they had been attacked by the Indians. The Spaniards would immediately send out a detachment in pursuit, when they were led into an ambuscade, and every soul cut off. They pursued this course so long that the whole province became alarmed at the rapid manner in which their enemies multiplied; but some circumstances leading to a suspicion, they made use of the superstition of these people for their ruin. Some officers disguised themselves like friars, and went round amongst the Indians, pretending to be possessed of the spirit of prophecy. They preached up to them that the day was approaching when a general deliverance from the Spanish tyranny was about to take place, and invited the Indians to join with them in promoting the work of God. The poor creatures came forward, and in their confessions stated the great hand that had already been put to the work. After they had ascertained the nature and extent of the conspiracy, and obtained a body of troops, they commenced the execution, and put to death about four hundred of them. This struck terror and dismay throughout the Indian villages, and they durst not rise to support their freedom and independence."

Durango or Guadiana, the principal city, is the residence of the intendant and of a bishop. It is situated in the most southern part of the province, in long. 107. W. and lat. 25. N., at 170 leagues distance in a straight line from the city of Mexico, and 289 leagues from the town of Santa Fe, in New Mexico. The elevation of the town above the sea level is 6800 feet. There are frequent falls of snow, and the thermometer descends to 14° Fahrenheit below the freezing point. The city was founded in 1559. The population in 1803 was 12,000, but Major Pike makes it 40,000. He also states that the city is infested in a very remarkable manner by scorpions. "They come out of the walls and crevices in May, and continue for about a fortnight in such numbers that the inhabitants never walk in their houses after dark without a light, and always shift or examine the bed-clothes and beat the curtains previously to going to rest, after which the curtains are secured under the bed."

In the midst of a very level plain, between this city, the plantations Del Ojo and Del Chorro, and the town of Nombre de Dios, which lies in the road to the famous mines of Sombrereto, there arises a singular group of rocks, of a very grotesque form, covered with scoria, called La Breña. They extend twelve leagues from north to south, and rise from east to west, and appear to be a volcanic

production, consisting of basaltic amygdaloid. On the summit of one of the neighbouring mountains (the Treayle), is found a crater 300 feet in circumference and 100 feet in perpendicular depth. In the environs of Durango there is also to be found, insulated in the plain, an enormous mass of malleable iron and nickel, said to weigh upwards of 40,000 pounds avoirdupois, and corresponding in its composition to the aëroliths which fell in 1751, near Agram, in Hungary. Major Pike also informs us that there is "a mountain or hill of loadstone" about a hundred miles south of Chihuahua.

DURATION, an idea obtained by attending to the succession of feelings and thoughts in the mind. Duration, as marked by certain periods and measures, is what we most properly call *time*.

DURBUNGAH, a town of Hindustan, province of Bahar, district of Tirhoot, fifty-five miles north-north-east from Patna. The inhabitants are chiefly Mahomedans, who support themselves by breeding horses. Long. 85.54. E. Lat. 25. 7. N.

DUREN, a circle in the Prussian government of Aix-la-Chapelle, extending over 122 square miles, and containing 38,048 inhabitants, in three cities, one market-town, and twenty-seven villages. The chief place, a city of the same name, is situated on the river Roer, and is a manufacturing place for fine cloths, blankets, paper, and ironmongery. It contains four churches, and 4938 inhabitants.

DURER, ALBERT, descended of an Hungarian family, and born at Nuremberg in May 1471, was one of the best engravers and painters of his age. He was a man of letters and a philosopher, and an intimate friend of Erasmus, who revised some of the pieces which he published. He was a man of business also, and for many years the leading magistrate of Nuremberg. Though not the inventor, he was one of the first improvers of the art of engraving; and he bethought himself of working also in wood, on which he engraved the life and passion of Christ in thirty-six pieces, which were very highly esteemed. In many of those prints which he executed on copper, the engraving is exceedingly elegant. His Hell scene particularly, which was engraved in the year 1513, is as highly finished a print as ever was engraved, and as happily executed. In his wooden prints too we are surprised to see so much meaning in so early a master; the heads being well marked, and every part admirably executed. This artist seems to have understood the principles of design. His composition, too, is often pleasing; and his drawing generally good. But he knew very little of the management of lights, and still less of grace; yet his ideas are purer and more elegant than we could have supposed from the awkward archetypes which his country and education afforded. In a word, he was certainly a man of very extensive genius; and, as Vasari remarks, he would have been an extraordinary artist if he had had an Italian instead of a German education. His prints are very numerous, and were much admired and eagerly bought up in his own lifetime. He was rich, and chose rather to practise his art as an amusement than as a business. This eminent person died at Nuremberg, on the 6th April 1528, and was interred in St John's Church, where an inscription was placed over his remains. Durer wrote several books in German, which were translated into Latin by other persons, and published after his death. Among these we may mention, 1. *De Symmetria Partium in rectis formis Humanorum Corporum*, Nuremberg, 1532, Paris, 1557, fol.; 2. *Institutiones Geometricæ*, Paris, 1532; 3. *De Urbibus, Arcibus, Castellisque condendis et muniendis*, Paris, 1531; 4. *De Varietate Figurarum, et flexuris Partium, et gestibus Imaginum*, Nuremberg, 1534. (See *Reliquien von Albrecht Dürer, seinen Verehrern geweiht, Taschenbuch*

Duration
||
Durer.

Duresse für Deutschland's Kunstfreunde, zu Albrecht Dürer's dritter Secular-feier, Nürnberg, 1828.)

DURESSE, **HARDSHIP**, in *Law*, is where a person is kept in prison or restrained of his liberty contrary to order of law; or is threatened to be killed, maimed, or beaten. In which case, if a person so in prison, or in fear of such threats, make any specialty or obligation, by reason of such imprisonment or threats, such deed is void in law; and in an action brought on such specialty, the party may plead that it was brought by duress.

D'URFEY, **THOMAS**, more generally known by the familiar name of Tom d'Urfey, an English satirist and songster, of whom, though his name was as well known as that of any writer extant, yet few particulars have been collected. He was born in Devonshire; but when, where, or of what family, is uncertain. He was bred to the law, which he forsook for the more agreeable employment of writing plays and songs; and the latter he had so happy a talent both of writing and singing, that he received many favours from persons of quality on that account. Even crowned heads did not disdain his company. A writer of the *Guardian* (No. 67), tells us, he remembered to have seen Charles II. leaning on Tom d'Urfey's shoulder more than once, and humming over a song with him. This indeed was not extraordinary in so merry a monarch; but even the phlegmatic King William could relax the rigour of his Dutch muscles on hearing Tom sing a song. He was certainly by all accounts a cheerful, honest, good-natured man; but as this character does not include prudence, D'Urfey became poor as he grew old; and having prevailed on the managers of the playhouse to act his comedy of the *Plotting Sisters* for his benefit, Mr Addison wrote the above-mentioned paper in the *Guardian*, with another (No. 82) representing him in a good-humoured light, in order to procure him a full house. He died at an advanced age, in 1723.

DURHAM, **BISHOPRIC** OF, one of the counties of England. Before the arrival of the Romans it was included in the British principality of the Brigantes, and after their arrival made part of the province of *Maxima Caesariensis*. During the heptarchy it formed part of the kingdom of Northumberland, the fifth established, which began in 547, and ended in 827, having been governed by thirty-one kings. It was not mentioned by Alfred in his division of counties, being at that time considered as a part of Yorkshire. At present it is included in the northern circuit, in the province of York, and is a diocese and principality under the government of its own bishop, being a county palatine, the second in rank, and the richest in England. It is bounded on the north by Northumberland, on the south by Yorkshire, on the east by the North Sea, and on the west by Cumberland. It extends, according to the view of Mr Rickman, over 1061 square miles, and contains one city of the same name, nine market-towns, and 223 villages. It is divided into four wards. Until the passing of the reform act, it returned two members to the House of Commons for the county, and two for the city. The county has been formed, by that law, into two divisions, for the purpose of parliamentary elections; each of which returns two members. The northern division comprehends the wards of Chester and Easington, and the polling places are Durham, Sunderland, Lancheton, Wickham, Chester-le-Street, and South Shields. The southern division comprehends the wards of Darlington and Stockton, and the polling places are these two towns, and Bishop Auckland, Stanhope, Middleton-in-Teesdale, Barnard Castle, and Sedgefield. The following places within the county have by the same law obtained the privilege of electing two members each, viz. Gateshead, South Shields, Sunderland, and Tynemouth.

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This is the only county palatine remaining in England, and it is called *palatine*, a *palatio*, because the owners thereof had, in this county, the authority to use the royal prerogative, as fully as the king had in his palace. The palatine privileges were granted to this county probably on account of its bordering upon the inimical kingdom of Scotland, in order that the inhabitants, having justice administered at home, might not be obliged to go out of their county, and leave it open to an enemy's incursions; and that the owners, being encouraged by so large an authority, might be the more watchful in its defence. There is a court of chancery in this county, and the bishop is at the head of the administration of justice.

The western angle of the county of Durham is hilly and mountainous, with black, naked, and barren regions, crossed by a ridge of high hills, from whose sides issue numerous streams flowing to the sea. There are some beautiful and fertile valleys in the eastern and central parts, pleasantly varied with hill and dale, and alternately appropriated to corn and pasture. The waste lands occupy nearly 120,000 acres of the western part of the county; but in the southern districts many hundred acres have been inclosed and cultivated within the last forty years. The common fields are now but few; for the land belonging to the townships has been inclosed for above a century. There is a great portion of wet ground still remaining, although draining is carried on to a great extent.

Near the river Tees, and in some spots bordering on the other rivers, the soil is loam or a rich clay. At a farther distance from these rivers the soil is of an inferior quality, and marshy, with patches of gravel interspersed. The hills between the sea and an imaginary line from Barnard Castle on the Tees to Alansford on the Derwent, are covered with a dry loam, the fertility of which varies with its depth. From this line westward the summits as well as the sides of the hills are moorish wastes.

The woodlands of Durham are not of very considerable extent, trees being chiefly confined to the parks and seats of the nobility and gentry, but many plantations have been made of late years. The banks of the rivers and brooks, however, particularly in the vicinity of Durham, are fringed with wood of long growth and much value. The public roads are in general good, but those belonging to private districts and townships want improving.

The port of Stockton-upon-Tees is well situated for commerce. Hartlepool, situated on a promontory, nearly encompassed by the German Ocean, which on the south side of the town forms a capacious bay, is advantageously placed for the reception of vessels, and landing of troops from the Continent; and South Shields sends out many ships.

The mineralogical substances found in Durham are numerous and valuable. The coal mines are some of the most extensive and productive in the kingdom, and the quantity of this important article is so great as to exceed all calculation. At Sunderland the coal trade furnishes employment for 520 vessels, independently of the *keels* which convey the coal from the staiths to the ships, which are 492 in number. This coal is chiefly conveyed to the metropolis, though great quantities are sent to the different ports of the Baltic, and in time of peace to France and Holland. The whole quantity annually exported from Sunderland alone amounts to about 315,000 Newcastle chaldrons, each chaldron being equal to 53 cwt. The number of persons dependent on this trade is very great, and some years ago, when the consumption was by no means so great as it is at present, amounted to upwards of 26,000 on the river Wear only. The seams or strata now worked are five in number, extending horizontally for many miles, and are from twenty to one hundred fathoms

Durham. beneath the surface; while each stratum is from three to eight feet thick. Below these are several other seams of coal; and many parts of the county, besides those where the pits are now open, abound with this substance.

The principal lead mines of Durham are situated in Teesdale and Weardale; those of the former place have not been very productive, but the produce of the latter is of considerable value. The general method of working them is similar to that pursued in other mining counties. The ore of Weardale is melted by the blast-hearth, but in Teesdale air-furnaces have been introduced with much success.

Ironstone is found in the neighbourhood of Swalwell and Winlaton, where are the first iron-works in England.

Some excellent quarries of slate for buildings have been opened in different parts of the county. A beautiful black spotted limestone is dug up near Walsingham, and made into hearths, chimney-pieces, and other ornaments. This neighbourhood abounds also with fine millstones. The Newcastle grindstones are procured at Gateshead Fell; and firestone of high estimation, for building ovens, furnaces, and the like, is obtained in various parts of Durham, and exported in immense quantities.

Several extensive works for manufacturing salt from sea-water have long been established in the neighbourhood of South Shields; but owing to the discovery of a very singular salt spring at Birtley in this county, that process is not so much attended to now. This water rises at the depth of seventy fathoms, in an engine pit constructed for drawing water out of coal mines. It has for many years produced 20,000 gallons per day, four times more strongly impregnated with salt than any sea-water. In consequence of the discovery of this spring, about twenty-five years ago, a large and extensive manufactory of salt has been established near the spot, the quality of which is excellent. At Butterby, near Durham, is another salt spring, which issues from a rock in the river Wear, but is only visible when the water is low; it contains more of the sulphate of magnesia, or Epsom salt, than the spring at Birtley. Within a few yards of the Water-gate, on the south side of the town of Hartlepool, is a chalybeate spring, covered every tide by the sea. It is impregnated slightly with sulphur, which evaporates very quickly, leaving a sediment with salt of tartar; a gallon will yield 120 grains of sediment, two parts of which are nitrous, and the rest limestone.

Improvements in agriculture have been pursued with considerable spirit and success, in the environs of Darlington, chiefly through the patronage of a society of respectable gentlemen, who hold their meetings in the town, and bestow premiums upon merit. The usual rotation of crops in this county is, after summer fallow, wheat, oats, beans, or peas. On some spots of gravelly soil, turnips and barley are grown in almost perpetual succession, a crop of clover being sometimes interposed. The produce of wheat on good land is from twenty to thirty bushels per acre, the produce of barley is from thirty to forty, of oats from twenty to forty. The manures are chiefly lime and the produce of the fold-yard; and though abundance of sea-weed might be collected on the coast, the farmers make but little use of it. The farms are of a middling size, few of them exceeding 200 acres. The largest portion of each farm is appropriated to tillage, but towards the western extremity of the county the whole is applied to pasture. The leases seldom exceed six years, and are too frequently rendered of little value by injudicious restrictions. The leases held of the see of Durham are generally for life, or for twenty-one years, renewable every seven years on payment of a fine. The farm-houses are well situated and commodious, and improvements in farm-

ing and farming machinery become more and more common. **Durham.**

The cattle at Durham are, at present, in great repute; as, for form, weight, produce of milk, and quickness of fattening, there are none better. The sheep also, particularly the Tees Water breed, stand high in estimation. It is the largest breed in the island; the legs being longer, finer boned, and supporting a thicker and more firm and heavy carcass, than the Lincolnshire. They are also much wider on the backs and sides, and afford a fatter and finer grained mutton. The weight per quarter, in two-years' old wethers, is from twenty-five to thirty-five pounds, and in particular instances fifty-five pounds or more. The wool is shorter and lighter than some other English breeds. The Weardale sheep are small, but the meat is finely flavoured. When fat, the quarters seldom weigh more than fourteen or eighteen pounds each.

Durham, taking its dimensions into consideration, is inferior to no county in Great Britain for its numerous manufactures. It has cast-metal founderies, iron manufactories, potteries, glass-houses, copperas works, coal-tar and salt-works, quarries of marble, &c.; besides linen and woollen manufactories.

At the distance of about three miles from Darlington, at Oxenhall, are cavities in the earth, denominated Hell Kettles, to the origin of which are attached many fabulous conjectures. The diameter of the largest is not less than 114 feet, and that of the least seventy-five. About five miles from Hartlepool is one of the most singular and romantic clusters of rocks in the north of England, called Black Halls, formed by the force and constant action of the waves, which have separated enormous masses from the coast, washing some entirely away, but leaving others standing, like the vast towers of a cathedral; in some places the rock is perforated so as to resemble a fine pointed archway.

Near the north wall of the church-yard at Ryton is a large barrow, about twenty feet in perpendicular height, now planted with trees. It does not appear to have been opened; but a similar one, near Bradley Hall, in the same parish, inspected about thirty-five years ago, was found to contain a square cavity, formed by stones placed edgewise, in which a human body had been interred. Between one and two miles north of Brancepeth is Brandon Hill, a lofty eminence, on the summit of which is a remarkable tumulus, of an oblong form, 120 paces in circumference at the base, and about twenty-four feet in perpendicular height. It does not appear to have been opened. One mile north of Eggleston is an ancient structure, called the Standing Stones. This originally consisted of a cairn in the centre, surrounded by a trench, and that again encompassed by a circular arrangement of rough stones, many of which have been removed and broken, to repair the roads. Near a brook, at a small distance, is a large barrow, crossed from east to west by a row of stones.

On Fullwell Hill, a gigantic skeleton and two Roman coins were discovered about fifty-five years ago, together with a small urn of unbaked clay. Several copper coins have been found at the village of Whitburn. Some coins of the Emperor Hadrian were found while widening the road near Gateshead, which is supposed to have been a Roman station.

South Shields was the *ad finem* of Richard of Cirencester's itinerary, as appears from the Roman altars, coins, and other relics found there. Evchester, a small irregular village, is supposed to be the *Vindomara* of Antoninus; many Roman inscriptions, and an urn of uncommon form, nearly a yard high and seven inches wide, with a small cup in the centre, having been found there. Chester-le-Street has been supposed to be the *Condercum* of the

Durham. Romans, situated on the military way leading to New-castle. Glanibanta, near the village of Lanchester, is another Roman station, which has survived the ravages of cultivation in an extraordinary degree, and is one of the most perfect in the kingdom. It occupies a fine eminence, and is of an oblong figure, being 174 paces from north to south, and 160 from east to west, within the vallum. In some parts the wall still remains perfect; the outside is perpendicular, twelve feet in height, and built of ashler work in regular courses, each stone being about nine inches thick and twelve long. The site of the Prætorium is clearly distinguishable. Binchester, the seat and manor of the Wren family, is the site of the Roman station called *Vinovium* by Antoninus. Its figure and extent seem nearly similar to those of the station just mentioned; but the walls have been destroyed, and the area inclosed and cultivated. A military way, it is supposed, issued from it, leading towards Chester-le-Street. Innumerable fragments have been discovered here.

The most ancient part of Durham Castle is the keep, now a mere shell; the magnificent hall is fast going to decay. Hilton Castle, an ancient baronial residence of the Hyltons, is situated in a pleasant vale on the north side of the Wear, about three miles from Wearmouth: its present form is that of an oblong square; the interior consists of five stories; the rooms are small, and exhibit every symptom of neglect and decay. Ravensworth Castle, the seat of Sir Thomas Henry, occupies part of the site of an ancient castle, which seems to have formed a quadrangle, having a square tower at each angle, connected by a curtain wall. Two of the towers are built up in the offices, the others are partly in ruins. Lumley Castle, about a mile to the east of Chester-le-Street, is one of the seats of the Earl of Scarborough. It forms a quadrangle, with an area in the centre; at each angle are projecting turrets of an octangular form; it is a grand model of the taste of its age. Brancepeth Castle, an irregular but stately pile, was erected about Stephen's reign, by the family of Bulmers. The original building has had many modern improvements added to it by the present proprietor. The castle of Bishop Auckland stands on the north angle of the town, and, together with its courts and offices, covers about five acres of ground. Raby Castle, the magnificent seat of the Earl of Darlington, owes its splendour to the Earl of Westmoreland, who enlarged a more ancient castle which stood here prior to the year 1379. The present mansion of Streatham Castle was erected on the foundation of the old castle at the beginning of the last century, and several of the apartments are retained in it. Barnard Castle is situated on the southern acclivity of an eminence, rising with a steep ascent from the river Tees; its ruins cover an extensive plot of ground.

Kepier Hospital, near Durham, was founded in 1112; but the only part of the monastic buildings now standing is the gateway, a strong and not unhandsome piece of masonry with pointed arches. The ruins of a monastery for gray friars may be seen at Hartlepool. Several remains of monastic buildings occur near the church at Monk Wearmouth. The monastery of Jarrow may still be traced in its ruins on the summit of an elevated ridge near the church. On the east side of the main street of Gateshead are the ruins of St Edmond's Monastery, which appears, from Bede, to have been established before the year 653. Finchall Priory was beautifully situated in a vale on the banks of the Wear; the ruins cover an extensive plot of ground, but are so much dilapidated that the original appropriation of their respective parts can be traced only with great difficulty. The remains of a chapel at Bear Park are most perfect, and display some neat ornamental architecture. There is at Walsingham the ruins

of a considerable building, inclosed with a deep moat, supposed by some to have been a part of a monastery.

The ecclesiastical buildings now remaining, and most worthy of notice, are, the Cathedral of Durham, begun in 1093, in the Saxon and Norman style; Sedgfield Church, in the Saxon style; Bishop Wearmouth Church, supposed to have been founded very soon after the restitution made by Athelstan; and the parish church of Brancepeth, an ancient structure of the conventual form, but apparently of different ages.

The county of Durham contains a great number of noblemen and gentlemen's seats. The following are some of the principal: Streatham Castle, the seat of the Earl of Strathmore; Shincliff-Hall, that of R. Scott, Esq.; Croxdale-Hall, that of W. Salvin, Esq.; Raby Castle, that of the Duke of Cleveland; Lumley Castle, that of the Earl of Scarborough; Castle Eden, that of R. Burdon, Esq.; Harwicke, that of M. Russell, Esq.; Windleston, that of Sir John Eden, Bart.; Grange-Hall, that of G. Allan, Esq.; Winyard, that of the Marquis of Londonderry; Seaham, that of Sir R. Milbanke, Bart.; Ravensworth Castle, that of Sir S. H. Liddel, Bart.; Axwell Park, that of Sir T. Clavering, Bart.; Gibside, that of the Earl of Strathmore; Lambton Hall, that of Lord Durham; and Bradley Hall, that of the Bowes family.

The following titles are furnished from this county: Earl of Darlington to the Duke of Cleveland; Earl of Stanhope; Viscount Lumley to the Earl of Scarborough; Baron Auckland to the Eden family; and Baron Durham to the family of Lambton.

The inhabitants of this county, by accounts of doubtful accuracy, amounted in the year 1700 to 95,500, and in 1750 to 135,000. By the four decennial returns they are stated as follows: In 1801 they amounted to 160,561, in 1811 to 177,625, in 1821 to 207,673, and in 1831 to 253,700. The annual value of the real property appears by the assessment of 1815 to have been £.791,359.

DURHAM, a city, the capital of the county of that name, 260 miles from London. It is situated on the river Wear, which nearly surrounds it, and contributes to the fine situation; the castle and cathedral standing on an eminence, communicate no inconsiderable share of beauty. Besides the cathedral, there are six parish churches. The see is the most richly endowed of any in England, and the prebendaries are of great value. In the vicinity of the city are many interesting remains of antiquity. The corporation consists of a mayor, twelve aldermen, and twenty-four common council men, who nominate the freemen, by whom two members are returned to parliament. The market, held on Saturdays, is well attended. There is very little of trade, and there are no manufactures. The inhabitants amounted in 1801 to 7530, in 1811 to 6763, in 1821 to 9822, and in 1831 to 10,125.

DURKHEIM, a city, the chief place of a canton in the circle of the Rhine, in the kingdom of Bavaria. It stands on the river Isenach, and contains 500 houses, with 3081 inhabitants, who grow much wine.

DURLACH, a circle in the grand duchy of Baden, containing one city, two market-towns, and twelve villages, with 12,626 inhabitants. The capital is of the same name, situated on the river Pfing. It contains 471 houses, and 3873 inhabitants employed in making linen cloth, China ware, and other goods, and in growing fruit and wine.

DUROCHSKOI, a town of Asiatic Russia, in the government of Irkutsk, on the confines of China, near the Argun, 160 miles south-south-east of Nertchinsk.

DURON, an island in the Straits of Malacca, about twelve miles in length and three in breadth. Long. 103. 30. E. Lat. 0. 42. N.

DUROTRIGES, an ancient British nation, established

Durham
||
Duro-
triges.

Durour's
Island
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Dussara.

in that part of the country which is now called Dorsetshire. Their name is derived from the two British words *dur*, water, and *trigo*, to dwell; and it seems pretty evident that they obtained their name from the situation of their country, which lies along the sea coast. It is not very certain whether the Durotriges formed an independent state under a prince of their own, or were united with their neighbours the Danmonii; for they were reduced by Vespasian under the dominion of the Romans, at the same time and with the same ease as the latter, and never afterwards revolted. The peaceable disposition of the inhabitants was probably the reason why the Romans had so few towns, forts, and garrisons in this pleasant country. Dorchester, its present capital, seems to have been a Roman city of some consideration, though our antiquaries are not agreed about its Roman name. It is most probable that it was the Durnovaria in the twelfth Iter of Antoninus. Many Roman coins have been found at Dorchester. The military way, called Jeening Street, passed through it; and some vestiges of the ancient stone-wall with which it was encompassed, and of the amphitheatre with which it was adorned, are still visible. The country of the Durotriges was included in the Roman province called *Flavia Cæsariensis*, and was governed by the president of that province as long as the Romans maintained any footing in these parts.

DUROUR'S ISLAND, in the East Indian Ocean, discovered by Captain Carteret in 1767. Long. 143. 21. E. Lat. 1. 15. S.

DURRAJAH, a town of Hindustan, belonging to the Mahrattas, in the province of Malwah, twenty-five miles north-west from Bopal. Long. 77. 9. E. Lat. 23. 28. N.

DURRAMPOOR, a town of Hindustan, in the province of Aurungabad, fifty miles south-south-east from Surat. Long. 73. 23. E. Lat. 20. 34. N.

DURRESTEIN, a town of Austria, in the province of the Lower Ens, and circle of Upper Manhartsberg. It is situated on the banks of the Danube, and belongs to Count Staremburg. Above it are the ruins of a castle in which Richard king of England was kept a prisoner. Near to it are extensive quarries of millstones and grindstones. The inhabitants are about 1000.

DURSLEY, a market-town of the hundred of Berkeley, in the county of Gloucester, 108 miles from London. It is a corporate town, but has long ceased to elect members of parliament. A considerable quantity of broad cloth is made, chiefly for the China trade. A market, held on Thursday, is well supplied. The inhabitants amounted in 1801 to 2379, in 1811 to 2580, in 1821 to 3186, and in 1831 to 3226.

DURY, JOHN, a Scotch divine, who travelled much, and laboured with great zeal to reunite the Lutherans with the Calvinists. His discouragements in this scheme started another still more impracticable, namely, to reunite all Christians by means of a new explication of the Apocalypse, which he published at Frankfort in 1677. He there enjoyed a comfortable retreat in the country of Hesse; but the time of his death is unknown. His letter to Peter du Moulin, concerning the state of the churches of England, Scotland, and Ireland, was printed at London in 1658, under the superintendence of Du Moulin, and is esteemed curious.

DUSKY BAY, on the west coast of Tarai Poenammoo, one of the islands of New Zealand. It is of considerable extent, and affords good anchorage in coves and harbours near the shore. In other parts of it the water is very deep. This bay was discovered by Captain Cook in 1769. Long. 166. 48. E. Lat. 45. 40. S.

DUSSARA, a fortified town of Hindustan, province of Gujerat, which contains about 1300 houses, which are

chiefly possessed by Kurbatties; the remainder of the population being Coolees, Rajpoots, and other castes, besides a few Banyans. This place, with twelve surrounding villages, is the property of a Mahomedan zemindar, of Arabian descent, one of whose ancestors, about the year 1209, was put to death for killing a cow, and he has since been considered as a martyr, and his tomb is held in high esteem. The military force of the chief is estimated at 2000 horsemen and 100 infantry.

DUSSAULX, JOHN, a French writer, best known as the translator of *Juvenal*, was born at Chartres, on the 28th of December 1728. He studied first at La Fleche, and afterwards at Paris; and having obtained the situation of a commissary in the *gendarmerie*, he served under the Marshal de Richelieu, in Hanover, during the seven years' war. At the age of twenty-one he was admitted a member of the academy at Nanci; and in 1770 he published his translation of *Juvenal*. This work procured him admission into the Academy of Inscriptions; and he was also appointed ordinary secretary to the Duke of Orleans.

For some years he quietly prosecuted his literary occupations at Paris; but, upon the breaking out of the Revolution, his enthusiastic disposition led him to adopt its principles; and he took part in the debates of the legislative assembly. He spoke and voted, however, at all times for moderate measures; and, on several occasions, he was employed to calm the passions of the people during public tumults. At the memorable sitting of the convention of the 15th of January 1793, he voted that the king should be detained in custody during the war, and banished on the return of peace. It is rather remarkable, that when the committee of public safety wished to send him to the scaffold, his pardon was obtained by Marat, who represented him as an old dotard, incapable of becoming dangerous. He became president of the council of ancients in the month of July 1796, but left it in 1798. At the sitting of the 27th of April, he took leave of the assembly in a speech which was ordered to be printed. He died on the 16th of March 1799, after a long and painful illness.

Dussaulx was a man of considerable literary attainments, and amiable, upright, and disinterested in his conduct. His translation of *Juvenal* is esteemed the best version of that poet in the French language. His other works are, *Mémoires sur les Satiriques Latins*; *Lettres et Réflexions sur la fureur du Jeu, auxquelles on a joint une autre Lettre Morale*, Paris, 1775; *Discours sur la Passion du Jeu dans les différents Siècles*; *De la Passion du Jeu, depuis les temps anciens jusqu'à nos jours*, 1779, 8vo; *Vie de l'Abbé Blanchet*, prefixed to the *Apologues and Tales* of that author, Paris, 1784, 8vo; *De l'Insurrection Parisienne, et de la prise de la Bastille*, Paris, 1790; *Lettre au Citoyen Fréron*, 1796, 8vo; *Voyage à Barrège, et dans les Hautes-Pyrénées*, Paris, 1796, 2 vols. 8vo; *De mes Rapports avec Jean-Jacques Rousseau, &c.* Paris, 1798, 8vo, a curious work, which throws considerable light on the character of that celebrated man.

Marie-Jeanne Lieutau, the widow of Dussaulx, published memoirs of his life, which are exceedingly interesting. See also Palissot, *Mémoires sur la Littérature*; and *Biographie Universelle*.

DUSSELDORF, a circle of the Prussian province of Westphalia, on the right bank of the Rhine. Its extent is 144 square miles, and it comprehends three cities, two market-towns, and thirty-four villages, with a population of 28,500 inhabitants.

DUSSELDORF, a city, the capital of the circle of the same name, in the Prussian dominions. It stands where the river Dussel falls into the Rhine. It is one of the finest cities of Germany; and, though deprived of the

Dussaulx
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Dusseldorf.

Dust
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Dutens.

splendour it exhibited under its ancient dukes, has become a flourishing place by the introduction of various manufactures. The former fortifications are converted into extensive and prolific gardens. It contains three Catholic, one Lutheran, one reformed church, and ten chapels, with a house of industry, penitentiary, and an hospital, with appropriate institutions for education. The houses are 1387, and the inhabitants, including the military, in 1817 were 18,084. Long. 6. 40. 35. E. Lat. 51. 14. 12. N.

DUST, or DUSTEE, a river of Persia, flowing from the interior through the province of Mekran, from the southern shore of which it is discharged into the Indian Ocean. Its course is supposed to extend, under different appellations, about 1000 miles.

DUTENS, LOUIS, a late French writer of some celebrity, was born at Tours, of Protestant parents, on the 15th of January 1730. In his youth he addicted himself to poetry; and in 1748 he repaired to Paris and composed a tragedy, entitled *The Return of Ulysses to Ithaca*, which he showed to the comedian Lanoue, requesting him to bring it on the stage. The latter, however, returned the piece, advising the author to retouch it. Irritated at this advice, Dutens went to Orleans, where he got his play represented with great applause; but he soon became sensible of the faults of his work, and abandoned a species of composition in which he found he was not destined to excel. He soon afterwards went to England. Before leaving France, he accidentally became acquainted with Miss Pitt, sister to the Earl of Chatham, who gave him a letter to her brother; but after a short stay in London he returned to France. Not long afterwards, he was recalled to London by one of his uncles, to accompany a young English nobleman on his travels. Soon after his arrival, the young nobleman changed his intention; but, at the same time, he procured for Dutens the situation of a tutor in a private family. The father of the pupil was a man of considerable literary and scientific attainments, who instructed Dutens in those branches of knowledge in which he was deficient. In this manner he learnt Greek and mathematics; and he at the same time applied himself to the oriental languages, and to Italian and Spanish. At the end of three years his pupil died; but one of his sisters being deaf and dumb, Dutens undertook to educate her. His young pupil, however, having become enamoured of her instructor, he deemed it a matter of delicacy and of duty to leave the house.

About this time he was appointed chaplain and secretary to the Honourable Mr Stuart Mackenzie, the English minister at the court of Turin, and left England in the month of October 1758. In 1760, when Mr Mackenzie returned to England, the secretary remained at Turin as chargé d'affaires. Dutens came to England in 1762, and attached himself to the family of Lord Bute, who, before he retired from office in 1763, procured him a pension. He again went to Turin as chargé d'affaires, and during this second mission he undertook the task of collecting and publishing a complete edition of the works of Leibnitz, and wrote his work on the *Discoveries of the Ancients*. He afterwards quitted Turin, returned to Britain, and attached himself to the Duke of Northumberland, who procured him a living in the north of England. He accompanied the duke's son, Lord Algernon Percy, in his travels through France, Italy, Germany, and Holland; and while at Paris, he was chosen a member of the Academy of Inscriptions. In 1776 he returned to England, and soon afterwards accompanied Mr Mackenzie and his lady on a tour to Naples. On his return he was invited by Lord Mountstuart, who had been appointed envoy extraordinary, to accompany him to Turin, and Dutens found

himself for the third time chargé d'affaires at that court, during a short absence of the envoy. From Turin, which he left on account of some unpleasant circumstances, he went to Florence, and thence to Rome. He was in Paris in 1783, and returned to London the following year. The revenue he derived from his living of Elsdon, amounting to L.800 per annum, together with a considerable legacy left him by Mr Mackenzie, and estimated at L.15,000, enabled him to pass the remainder of his life in affluence, and in the best company. He died at his house, Mount Street, Grosvenor Square, on the 23d of May 1812.

Dutens was the editor of the works of Leibnitz, published at Geneva, 1769, in 6 vols. 4to; of the Greek pastoral romance of *Daphnis and Chloe*, by Longus, 1776, 12mo, and of Dacier's translation of the *Manual of Epictetus*, 1775, 18mo. He was also the author of the following works: *Le Caprice Poétique*, a collection of poems, 1750, 16mo. *Recherches sur l'origine des Découvertes attribuées aux Modernes*, 1766, 2 vols. 8vo, 4th edition, 1812. *Poesies*, 1767, 12mo, and 1777, 8vo. *Le Tocsin*, Rome, 1769, 12mo, reprinted under the title of *Appel au bon Sens*, London, 1777, 8vo. This work was directed against the French philosophers, and was published anonymously. *Explication de quelques médailles de Peuples, de Villes, et de Rois, Grecques et Pheniciennes*, 1773, 4to. *Explication de quelques médailles du cabinet de Duane*, 1774, 4to. *Troisième Dissertation sur quelques médailles Grecques et Pheniciennes, où se trouvent des observations pour servir à l'étude de la Paléographie Numismatique*, 1776, 4to. Dutens, at the same time, published a more complete edition of the two preceding works. *Logique, ou l'art de Reasonner*, 1773, 12mo, 1777, 8vo, and reprinted also in his miscellaneous works. *Du miroir ardent d'Archimède*, 1755, 1777, 8vo; *Des pierres précieuses et des pierres fines, avec les moyens de les connaître et de les évaluer*, 1776, 12mo, and reprinted at London and Paris. *Itinéraire des routes les plus fréquentées, ou Journal d'un Voyage aux principales Villes d'Europe*, 1775, 8vo, and frequently republished with additions and improvements. *Lettre à M. D. B. (Debure) sur la réfutation du livre l'Esprit*, par J. J. Rousseau, 1779, 12mo, which contains some letters of Helvetius and Rousseau. *De l'Eglise, du Pape, de quelques points de controverse, et moyens de réunion de toutes les Eglises Chrétiennes*, 1781, 8vo; several times reprinted, and finally under the title of *Considérations Théologiques sur les moyens de réunir toutes les Eglises Chrétiennes*, 1798, 8vo. *Œuvres mêlées*, 1784, 8vo. Under the same title almost the whole works of Dutens were collected and published at London, 1797, 4 vols. 4to. *L'Ami des étrangers qui voyagent en Angleterre*, 1789, 8vo, frequently reprinted. *Histoire de ce qui s'est passé pour le rétablissement d'une régence en Angleterre*, 1789, 8vo. *Recherches sur le tems le plus reculé de l'usage des Voutes chez les anciens*, 1795. *Mémoires d'un Voyageur qui se repose*, Paris, 1806, 3 vols. 8vo. The two first volumes contain the life of the author, written in a romantic style; the third bears the title of *Dutensiana*, and is filled with remarks, anecdotes, bon mots, and so forth. Dutens is the author of the *Catalogue of Medals* in Swinburne's *Travels*, and of the French text to the second volume of the *Marlborough Gems*. There is a *Memoir* of his in the Collection of the Academy of Inscriptions, and he also published a small tract on the *Iron Mask*. He was a member of the Royal Society of London, and had the title of historiographer to the king. (See *Memoirs of Dutens* in the *Gentleman's Magazine* for 1812; Chalmers's *Biographical Dictionary*; and *Biographie Universelle*.)

DUTCHY. See DUCHY.

DUTY, in general, denotes any thing that one is obliged to perform.

Dutens
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Duty.

Duty
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Dwarf.

DUTY, in commerce, signifies an impost laid on merchandise, at importation or exportation, commonly called the duties of customs; also the taxes of excise, stamp duties, &c. See **POLITICAL ECONOMY**, and **TAXATION**.

DUUMVIRI, in Roman antiquity, a general appellation given to magistrates, commissioners, and officers, where two were joined together in the same functions.

DUUMVIRI Capiales were the judges in criminal causes. From their sentence it was lawful to appeal to the people, who alone had the power of condemning a citizen to death. These judges were taken from the body of the decuriones, and had great power and authority; they were members of the public council, and had two lictors to walk before them.

DUUMVIRI Municipales were two magistrates in some cities of the empire, answering to the consuls at Rome. They were chosen out of the body of the decuriones, and their office commonly lasted five years, upon which account they were frequently termed *quinquinales magistratus*. Their jurisdiction was of great extent. They had officers who walked before them, carrying a small switch in their hands; and some of them assumed the privilege of having lictors carrying axes and the fasces or bundles of rods before them.

DUUMVIRI Navales were the commissaries of the fleet, first created at the request of M. Decius, tribune of the people, in the time of the war with the Samnites. The duties of their office consisted in giving orders for the fitting out of ships, and issuing their commissions to the marine officers, &c.

DUUMVIRI Sacrorum were magistrates created by Tarquinius Superbus for the performance of the sacrifices, and for keeping the sibyls' books. They were chosen from among the patricians, and held their office during life; they were exempted from serving in the wars, and from the offices imposed on the other citizens; and without them the oracles of the sibyls could not be consulted.

DWAL, in *Heraldry*, the herb nightshade, used by such as blazon with flowers and herbs, instead of metals and colours, for sable or black.

DWARACA, a town and celebrated temple of Hindustan, province of Gujerat, situated at the south-west extremity of the peninsula. There are twenty-one villages belonging to Dwaraca, containing 2500 houses, and, on the most accurate calculation, 100,000 inhabitants. The inhabitants were formerly much addicted to piracy, but of late years have been restrained by a treaty with the British. The temple is fabled to have been the residence of Krishna, at which 15,000 pilgrims annually pay their devotions, which is an abundant source of wealth to the Brahmins. Long. 69. 15. E. Lat. 22. 21. N.

DWARE, in general, an appellation given to things greatly inferior in size to that which is usual in their several kinds. Thus there are dwarfs of the human species, dwarf dogs, dwarf trees, and the like.

The Romans were passionately fond of dwarfs, whom they called *nani* or *nanæ*, insomuch that they often used artificial methods to prevent the growth of boys designed for dwarfs, by inclosing them in boxes, or by the use of tight bandages. Augustus's niece, Julia, was extremely fond of a dwarf called Sonopas, who was only two feet and a handbreadth in height. We have many other accounts of human dwarfs, but most of them deformed in some way or other, besides the smallness of their size. Many relations concerning dwarfs we must necessarily look upon as not less fabulous than those concerning giants. The following history, however, which there is reason to regard as authentic, is too remarkable not to be acceptable to the generality of our readers.

Jeffery Hudson, the famous English dwarf, was born at Oakham, in Rutlandshire, in 1619; and about the age of seven or eight, being then but eighteen inches high, he was retained in the service of the Duke of Buckingham, who resided at Burleigh-on-the-Hill. Soon after the marriage of Charles I. the king and queen being entertained at Burleigh, little Jeffery was served up at table in a cold pie, and presented by the duchess to the queen, who kept him as her dwarf. From seven years of age till thirty he never grew taller; but after thirty he shot up to three feet nine inches, and there remained fixed. Jeffery became a considerable part of the entertainment of the court. Sir William Davenant wrote a poem called *Jeffreidos*, on a battle between him and a turkey-cock; and in 1638 was published a very small book, called the *New Year's Gift*, presented at court by the Lady Parvula to the Lord Minimus, commonly called *Little Jeffery*, her majesty's servant, written by Microphilus, with a little print of Jeffery prefixed. Before this period Jeffery was employed on a negotiation of great importance; he was sent to France to fetch a midwife for the queen; and on his return with this gentlewoman and her majesty's dancing-master, and many rich presents to the queen from her mother Mary de' Medicis, he was taken by the Dunkirkers. Jeffery, being thus made of consequence, began to think himself really an important personage. He had borne with little temper the teasing of the courtiers and domestics, and had many squabbles with the king's gigantic porter. At last, being provoked by Mr Crofts, a young gentleman of family, a challenge ensued; and Mr Crofts coming to the rendezvous armed only with a squirt, the little creature was so enraged that a real duel ensued; and the appointment being on horseback with pistols, to put them more on a level, Jeffery, with the first fire, shot his antagonist dead. This happened in France, whither he had attended his mistress in the troubles. He was again taken prisoner by a Turkish rover, and sold into Barbary. But he probably did not remain long in slavery; for at the beginning of the civil war he was made a captain in the royal army, and in 1644 attended the queen to France, where he remained till the Restoration. At last, upon suspicion of his being concerned in the Popish plot, he was seized in 1682, and confined in the Gatehouse, Westminster, where he ended his life, in the sixty-third year of his age. This little hero cuts a considerable figure in Sir Walter Scott's novel of *Peveril of the Peak*.

In the *Memoirs of the Royal Academy of Sciences*, a relation is given by the Count de Tressau, of a dwarf called *Bebe*, kept by Stanislaus, king of Poland, and who died in 1764, at the age of twenty-three, when he measured only thirty-two inches. At the time of his birth he measured only between eight and nine inches. Diminutive as were his dimensions, his reasoning faculties were not less scanty, appearing indeed not to have been superior to those of a well-taught pointer. But that the size and strength of the intellectual powers are not affected by the diminutiveness or tenuity of the corporeal organs, is evident from a still more striking instance of littleness, given us by the same nobleman, in the person of M. Borulawski, a Polish gentleman, whom he saw at Luneville, and who at the age of twenty-two measured only twenty-eight inches. This miniature of a man, considering him only with reference to his bodily dimensions, appeared a giant with regard to his mental powers and attainments. He is described by the count as possessing all the graces of wit, united with a sound judgment and an excellent memory; so that we may with justice say of M. Borulawski, in the words of Seneca, and nearly in the order in which he has used them, *posse ingenium fortissimum ac beatissimum sub quolibet corpusculo latere*.

Dwarf.

DYEING

History. Is the art of communicating a new and permanent colour to any substance whatever; but it is usually confined to the art of giving colours to wool, silk, feathers, cotton, or flax, or the thread or cloth formed of any of these substances. To this more limited signification we shall restrict ourselves in the following treatise. For dyeing or staining *paper, wood, bone, leather, marble, &c.* the reader is referred to these articles. We shall divide this article into six chapters. In the first we shall give a rapid sketch of the history of the art; in the second we shall treat of the nature and properties of wool, feathers, silk, cotton, and flax, of which the fabrics to be dyed are composed; in the third chapter we shall treat of *mordants*, or the substances by means of which the colours are fixed on the cloth or thread. The fourth chapter will be occupied with the mode of dyeing the simple colours, or *red, yellow, blue, black, and brown*. The object of the fifth chapter will be the compound colours, or the different shades of *green, purple, orange, and gray*. The sixth chapter will be occupied with a sketch of the processes of calico printing. Our object will be to give a general view of the processes, and to explain the theory of dyeing, so far as the present state of our knowledge enables us to go. We shall avoid minute details, except when they may be necessary for understanding the nature of the processes.

CHAPTER I.

HISTORY OF DYEING.

Nature has implanted in man a sense of pleasure which he derives from beholding lively colours properly displayed and contrasted. And this sense receives ample gratification from the gay plumage of the feathered tribes, and the endless variety displayed in the blossoms of the vegetable kingdom. The diversity in the colours of flowers must have early attracted the attention of man, and he could scarcely avoid feeling a desire to employ them to adorn his person; but their fading nature fitted them only for a temporary ornament. It would naturally occur to attempt to transfer some of the most lively colours of the vegetable kingdom either to the skin of the naked savage, or to the different articles of dress with which he covered himself up from the cold, or with which he decorated his person.

A few trials would speedily show that the gay colours of most flowers could not be transferred to any article of dress, at least without a great diminution of their splendour; but a considerable difference would be observed depending upon the colour of the flower. The *red* flowers would either lose their colour altogether, as they would communicate to cloth, not a *red*, but a *blue* colour. The yellow coloured berries, on the other hand, would be found in some instances to communicate a very lively and beautiful, though not a permanent colour.

By multiplying trials, various roots, barks, and fruits would be found capable of communicating certain colours to cloth. These facts would be treasured up, and thus a beginning would be made of the art of *dyeing*. Accordingly we find this art practised to a greater or smaller extent in the most remote ages, and among the most

savage and barbarous nations. Even the lowest of the American tribes, in point of civilization, understood how to communicate several very fine colours, and considerable improvements in dyeing were borrowed from the Americans.

It would be in vain, therefore, to attempt to discover to whom the art of dyeing is indebted for its origin, as the practice of it precedes the origin of history. From the writings of Moses, who led the Israelites out of Egypt about 1555 years before the commencement of the Christian era, it is obvious that the art of dyeing had in his time made great progress in Egypt. He mentions blue, and purple, and scarlet, and badgers' skins dyed red.¹ There are some reasons for believing that what is translated in the Old Testament *fine linen* was in reality a cloth made of cotton wool. Indeed it is certain that cloth made of cotton was used in India and Egypt in the most remote ages. Cotton wool would naturally attract the attention of mankind in those countries where the plant which yields it grows. Now we know that the cotton plant is a native of India. India and Egypt are countries in which the processes of dyeing are as likely to have originated as any other; for they constitute the cradle of the human race, and civilization appears to have made earlier progress in them than in any other.

The art of dyeing was brought to a considerable degree of perfection at a very early period in Phœnicia. It appears that it was in Tyre where the method of dyeing woollen cloth *purple* was first discovered; and this discovery, there is reason to believe, is at least as old as the time of Moses. The purple was communicated by means of several species of univalve shell-fish, which no doubt abounded on the coast of Phœnicia. Pliny, in the thirty-sixth chapter of his sixth book, gives us an account of two species of shell-fish from which the purple was obtained. The first species was called *buccinum*, doubtless from some resemblance to a hunting horn; the second was called *purpura*. A single drop of the dyeing liquor was obtained from each fish by opening a vessel situated in the throat of the animal. The liquor, when extracted, was mixed with a considerable portion of salt, to prevent putrefaction. It was then diluted with five or six times as much water, and kept moderately hot in leaden or tin vessels, for the space of ten days, during which the liquor was frequently skimmed, to separate all impurities. After this, the wool, being first washed, was immersed and kept in the liquor for five hours. It was then taken out, carded, and again immersed and kept in the liquor till all the colouring matter was extracted. To produce particular shades of colour, carbonate of soda, urine, and a marine plant called *fucus*, were occasionally added. Several of these colours are particularly described by Pliny, though it is difficult to form an accurate conception of his meaning. The *purple* itself seems to have been similar to the colour of blood.

Pliny says the Tyrians first dyed their wool in the liquor of the *purpura*, and afterwards in that of the *buccinum*. We find allusions to this practice in several passages of the Old Testament. Doubtless Horace alludes to the same process when he says,

..... te bis Afro
Murice tinctæ
Vestiunt lanæ.

Od. ii. 16, line 35.

¹ Exodus, xxv. 4 and 5.

History. The shell-fish employed in this process were found abundantly both on the European and African shores of the Mediterranean. They still exist on these shores, and have been also met with abundantly on the coasts of England and France.

Purple. The purple mentioned in Exodus was probably that dyed by the Tyrians. Ezekiel, who wrote about 593 years before the Christian era, in his prophecy against Tyre, says, "Fine linen with brodered work from Egypt, was that which thou spreadest forth to be thy sail; blue and purple from the isles of Elishah, was that which covered thee."¹ By Elishah it is generally supposed that Elis, on the west side of the Greek Peloponnesus, was meant. Hence it would appear that the Tyrians in Ezekiel's time drew their supply of shell-fish for dyeing purple from the coast of Greece.

From Herodotus it appears that purple was worn in Greece 559 years before the Christian era. It gradually made its way to Rome, and was purchased with avidity, notwithstanding its high price. After the establishment of the emperors upon the ruins of Roman liberty, the use of the purple was limited to the emperor, people of inferior rank being prohibited from wearing it, on pain of death. This of course sadly diminished the extent of the manufactory. It continued to languish for some centuries, and then became extinct; and the mode of dyeing the Tyrian purple was lost for many ages, but was again revived during the seventeenth century by Mr Cole of Bristol, and during the eighteenth century by M. Reaumur of France. But by this time finer colours had been discovered, and cheaper processes brought into use. It was not therefore thought advisable by the dyers to resume the methods followed by their Tyrian predecessors.

With the exception of the processes followed in the dyeing of purple, we are ignorant of the practices of the ancient dyers, or of the degree of progress which this art had made. Pliny, under whose province an account of dyeing naturally came, has passed it over in silence, and has assigned as a reason for his conduct that it was not reckoned among the liberal arts. *Nec tingendi rationem omissemus, si unquam ea liberalium artium fuisset.*

Dyeing introduced into Greece.

The fine colours given in India to cotton cloths are universally known. The methods practised are no modern inventions, but were in common use when India was visited by Alexander the Great, and probably many ages before. These colours, which are both beautiful and permanent, prove that the methods of fixing gaudy colours on cotton were pretty far advanced. But these methods, as they have been described by Beaulieu and Bancroft, are so complicated, tedious, and imperfect, that they could be followed only where the wages of labour are exceedingly low, and never would answer in any part of Europe. There is reason to believe that the processes of dyeing cotton and linen were introduced into Greece only after the expedition of Alexander the Great into India.

The common people in Athens were very idle and very poor, spending their time in the public places, and receiving a daily pension of three oboli, or about fourpence halfpenny. But this sum would have purchased as much corn as three times the amount would do in this country; so that the income of a common Athenian citizen was equivalent to about thirteen pence halfpenny of our money. They went barefooted, and were dressed in garments which never had been dyed, but which were occasionally washed. The rich citizens wore garments which had been

dyed; and the most common colour was *scarlet*, communicated to the cloth by *hermes*, a dyestuff still in use, and which we shall describe in a subsequent part of this treatise. This colour, as Pliny informs us, was scarcely less esteemed than the Tyrian purple. Cloths of the scarlet colour were worn by the emperors; and scarlet and purple seem to have been often confounded together.

The modes of dyeing black, blue, yellow, and green, were brought by Alexander the Great into Greece from India, as Pliny informs us.

Among the Romans, new-married women wore a *yellow* veil, and this colour was reserved for the women. In the circus the four different factions were distinguished by four different colours, one belonging to each faction. These were the green (*prasinus*), the orange (*rufatus*), the blue (*venetus*), and the white. These factions, with their colours, were transferred to Constantinople, and long distracted that city.² We are ignorant of the dyestuffs by means of which these colours were given to cloth.³

The want of soap, which was unknown to the Greeks, and only known to the Romans in Pliny's time as a pomatum for the hair, must have greatly cramped the processes of the ancient dyers; nor have we any evidence that *alum* was known to them, though they must have employed some substitute, otherwise the red colour of the kermes could not have been fixed upon the cloth. Alum appears to have been well known to Geber, who wrote in the eighth century. He mentions different manufactories of it, and talks of it as a substance familiarly known in his time. Is it not possible that the mode of making it had been known to the Tyrian dyers, but kept by them as a profound secret? The purple and scarlet dye was still in use during Geber's time, and even continued to be practised in the eleventh century. Alum, then, was certainly used by the Tyrian dyers before their manufactory was finally extinguished; but even if we admit that the ancients were unacquainted with *alum*, yet it is obvious, from Pliny's account of *alumen*, that it was a substance found native; that there were different species of it, for he enumerates four or five, and one of these may have been a native combination of sulphuric acid and alumina, which (if pure) would doubtless answer all the purposes of a mordant.

The ancient dyeing processes, such as they were, continued to be practised in Constantinople as long as the Greek empire lasted. It was during the crusades that the republics of Venice and Genoa reached the highest summit of their power. They were trading and manufacturing communities, and made a point of making themselves acquainted with the different arts at that time practised in Greece. Dyeing was not neglected by them; but the art and trade of the dyers of Constantinople were transferred by them to Italy.

About the year 1300 a merchant of Florence accidentally discovered the method of making *archil*. He observed that a certain species of lichen (*lichen roccellus*), when macerated in urine, acquired a fine purple colour. This led him to try various experiments, which terminated in the discovery of *archil*, and in the application of it to the art of dyeing.

In the year 1429 the first collection of processes employed in dyeing was published in Venice, under the title *Mariegorla dell' arte dei Tentori*. A second edition of this book, with many additions, was published in 1510. Giovan Ventura Rosetti formed the project of making this

¹ Ezekiel, chap. xxvii. ver. 7.

² Berthollet has given a catalogue of the dyestuffs of the ancients, after Bischoff, *Elements de l'Art de la Teinture*, i. 14. We do not consider it as worth transcribing, because it is altogether conjectural.

³ See Gibbon's *Decline and Fall*, vii. 78.

History. work more complete and more useful. He travelled into those parts of Italy and the neighbouring countries where attention was paid to the processes of dyeing, in order to acquire the requisite information. The result of his acquisitions was published under the name of *Plictho dell arte de' tentori, che insegna tenger panni, tele banbasi e sede, si per l'arte maggiore, come per la commune*. It was published at Venice in the year 1548. A French translation of it appeared in Paris in the year 1716. This book constituted the first attempt at a methodical arrangement of the different processes. It even aimed at something like theory, though the state of knowledge at the time when it was written did not permit any successful explanation of the theory of dyeing.

**Introduc-
tion of
indigo and
cochineal.**

In the *Plictho* no notice is taken either of cochineal or indigo. Hence we may conclude that, in 1548, neither of these important dyestuffs had made their way into Europe. Pliny mentions indigo under the name of *indicum*; but it appears to have been used by the Greeks and Romans only as a paint; yet there can be little doubt that in India it had been employed from time immemorial as a dyestuff. Cochineal could not be known till after the discovery of America. It was used by the Mexicans as a dyestuff. In 1523 Cortes received orders from the court of Spain to multiply this precious insect, to collect it, and send it to Spain.

Cochineal by itself gives only a *crimson* colour; it dyes *scarlet* when mixed with a solution of tin. This fact was discovered accidentally by Cornelius Drebbel about the year 1630. He communicated his observation to his son-in-law Kuffelar, who was a dyer at Leyden. He soon brought the process to perfection, kept it a secret, and brought the scarlet colour into fashion. Soon after, the same process was discovered by a German chemist called Keffler, who carried his secret to London in 1643. A Flemish dyer called John Kloeck got information of the process in 1647, and it gradually made its way through every country of Europe.

Indigo, though a much more important dyestuff than cochineal, did not make its way into general use without the greatest difficulty. The use of it was prohibited in England during the reign of Elizabeth; and the prohibition was not taken off till the time of Charles II. It was equally prohibited in Saxony, where it was styled in the prohibition a corrosive substance, and called food for the devil. Restrictions on the use of indigo in dyeing were imposed also in France, though it was not altogether prohibited, as it had been in England and Saxony.

The reason of these prohibitions and restrictions was, that *pastel* and *woad* were employed for dyeing blue; and fears were entertained that indigo would supersede these dyestuffs altogether. Now, as they were the product of the different kingdoms of Europe when they were employed, it was erroneously concluded that the introduction of a better and cheaper dye would injure the country by throwing these plants out of cultivation.

**Improve-
ments in
France.**

The improvements in dyeing which took place in France may be dated from the administration of Colbert, who paid particular attention to the different branches of manufacture which were carried on by the French. In the year 1672 he caused a book of instructions for dyers to be published in Paris. This book was republished in 1708 under the following title: *Le teinturier parfait, ou instruction nouvelle et générale pour la teinture des laines et manufactures de laine de toutes couleurs, et pour la culture des drogues ou ingrédients qu'on y emploie*.

But Colbert's encouragement of dyeing was clogged with restrictions and prohibitions, which would have been fatal to the art, had it not been for the facility with which they were evaded. The revocation of the edict of Nantes in

the year 1685 was a fatal blow to the pre-eminence of France in manufactures. The most industrious and skilful workmen and artists were driven out of the country, and carried their knowledge and dexterity into Great Britain, Holland, and Prussia. Succeeding administrations endeavoured as far as possible to correct the fatal policy of Louis XIV. The art of dyeing in particular drew their attention, and the most eminent chemists which the country possessed were placed as a kind of superintendents of the art of dyeing. Their business was to endeavour to improve the processes, and to bring the art to a state of perfection. Dufay, Hellot, Macquer, and Berthollet, successively filled this important office; and each of these eminent men contributed somewhat to the improvement of the theory of dyeing. Dufay first formed tolerably accurate notions of the nature of colouring matters, and of the forces which made them attach themselves to cloth. Hellot published a well-arranged treatise on dyeing woollen cloth, such as it was practised in the best dyeing establishments in France; and Macquer gave an equally detailed account of the processes followed by the silk dyers. Macquer indeed meditated a general treatise on dyeing, and published a prospectus in the year 1791. But his great age, and the feeble state of his health for some years before his death, prevented him from completing the undertaking.

Berthollet, who was named his successor as superintendent of dyeing, published an excellent treatise under the title of *Elements de l'Art de la Teinture*, a second edition of which appeared in the year 1804. This work contains a very full and complete account of the processes of dyeing, such as they existed when Berthollet wrote; and is still well entitled to the attention of the practical dyer.

Scarcely any work upon dyeing deserving the name of a scientific treatise appeared in the English language till Bancroft published his *Experimental Researches concerning the Philosophy of Permanent Colours, and the best means of producing them by dyeing, calico printing, &c.* in the year 1794. Of this work a second volume afterwards appeared, not inferior in value to the first. But unfortunately the projected plan was never completed. Had this been the case, the work of Bancroft would have been by far the completest treatise on dyeing in any language.

Great improvements have been made of late years in calico printing, and several new dyeing materials have been introduced. Of these the most important is the bichromate of potash and the sulphate of manganese. The former communicates an indelible yellow, orange, and red; the latter various shades of brown equally indelible, and at present constituting a very fashionable mode of printing. The improvements in the dyeing of silk and woollen cloth are not so easily pointed out, though they are both numerous and important. One, however, may be mentioned; the substitution of the lac dye in most ordinary cases for cochineal. This last dyestuff is still used for giving a scarlet colour to superfine cloth; but for the coarser fabrics lac is almost universally substituted. The calico printers employ only cochineal, and, so far as we know, never use lac.

CHAPTER II.

OF THE NATURE AND PROPERTIES OF THE SUBSTANCES TO WHICH COLOURS ARE COMMUNICATED IN THE PROCESSES OF DYEING.

There has been much speculation among philosophical dyers respecting the nature of the colouring matters, and the way in which the different colours are induced by dye-

Substances to be coloured. Nature of colour and dye stuffs. ing; but these speculations have not led to any information of much value. It has been demonstrated by Newton that *light* is divisible into seven rays, distinguished by the following colours; *red, orange, yellow, green, blue, indigo, violet*. The colour of an object is owing to its having the property of reflecting or transmitting certain rays, while it absorbs the rest. Thus a red body reflects or transmits the red ray and absorbs the rest, an orange body reflects or transmits red and yellow, a green body reflects or transmits the yellow and blue rays, and a white body all the rays. There is reason for believing that the colouring matters employed as dyestuffs are all transparent, and that the colour is produced by their action on the light transmitted through them from the white fibres of the cloth. Those colouring matters that transmit all the rays equally leave the cloth white; if the blue ray be transmitted and the rest absorbed, the colour of the cloth will be *blue*, and so on. This is all that we know about the mechanical nature of the dyestuffs. On what the circumstance depends that causes a transparent body to absorb one kind of ray, and transmit another through it, we do not know, nor is it likely that any knowledge will ever be acquired respecting it. The speculations of Delaval, accounting for the colours given by dyestuffs by the size of the colouring particles, appear to us altogether unfounded, and quite inapplicable to the subject under discussion.

Silk and wool dye better than cotton and linen.

With respect to the aptitude of being dyed, and the brilliancy of the colours thus communicated, there is found to be very great difference in different tissues. Animal substances are much more easily dyed than vegetable substances. Of animal substances, *silk* receives colour, and the shades given are brighter and more beautiful than those which can be imbibed by any other tissue. Woollen cloth is also very fit for being dyed, and receives very brilliant colours with avidity, though in this respect it is inferior to silk. Cotton and linen are much more difficult to dye, and cannot be made to imbibe such brilliant colours as silk or woollen. Thus the rich scarlet given to cloth by the combined action of cochineal and the oxide of tin, has never been communicated to cotton cloth or linen. The Turkey-red dye, which is by far the finest and most permanent red that has ever been communicated to cotton cloth, is a crimson, or rather a crimson with a shade of brown. It has not the least approach to a scarlet.

Upon what this difference between animal and vegetable bodies in the capacity of receiving colours depends, we do not know. Both woollen and silk contain a notable quantity of azote among their constituents, while this principle is altogether wanting in cotton and linen. How far the property of easy dyeing depends upon the presence of azote it is impossible to say; but it is the only chemical difference in their constitution that can in the present state of our knowledge be pointed out. Both cotton and flax, so far as their chemical characters have been examined, are precisely similar in their properties to *lignin* or the woody fibres of trees, supposing them deprived of all their foreign ingredients. Now the constituents of lignin are as follows, according to the analysis of Prout.

Carbon.....	50.00
Hydrogen.....	5.55
Oxygen.....	44.45
	100.00

This is proportional to

3 atoms carbon.....	2.25
2 atoms hydrogen.....	0.25
2 atoms oxygen.....	2.00

4.5

Hence these substances (cotton and flax) must either be

composed of three atoms carbon, two atoms hydrogen, and two atoms oxygen, or of some multiple of these numbers. How many atoms go to the formation of an integral particle of cotton or flax cannot be known till some substance be discovered with which they are capable of entering into definite combinations.

The only attempt to determine the atomic constituents of silk and wool is that of Dr Ure, according to whom their composition is as follows.

	Silk.	Wool.
Azote.....	11.33.....	12.3
Carbon.....	50.69.....	53.7
Hydrogen.....	3.94.....	2.8
Oxygen.....	34.04.....	31.2
	100.00	100.0

These are equivalent to the following atomic numbers.

	Silk.	Wool.
Azote.....	13 atoms.....	14 atoms.
Carbon.....	135.....	143
Hydrogen.....	63.....	45
Oxygen.....	68.....	62

But a comparison between these two sets of bodies will be made with more advantage if we represent the number of atoms of the other constituents of each upon the supposition that the atoms of carbon in each is the same, or 66. On this supposition the composition will stand as follows.

	Lignin.	Silk.	Wool.
Azote.....	0 atoms.....	6.3 atoms.....	6.5 atoms.
Carbon.....	66.....	66.0.....	66.0
Hydrogen.....	44.....	30.8.....	20.7
Oxygen.....	44.....	33.2.....	28.5

If the analyses of these bodies constituted a near approximation to the truth, it would follow from a comparison of them: 1. That in lignin the hydrogen and oxygen exist in the proportions which constitute water, while in silk there exists an excess of oxygen, and in wool this excess is still greater. 2. In lignin there is no azote, whereas in silk and wool the atoms of azote amount to about one tenth of the atoms of carbon. 3. The atoms of hydrogen in silk are to those in lignin as three to four, and in wool as two to four; so that lignin contains twice as much hydrogen as wool does. 4. In silk the atoms of oxygen are to those in lignin very nearly as three to four; but in wool the number of atoms of oxygen is to that in lignin rather in a less ratio than that of three to four.

These facts lead us but a very little way in discovering the difference between the nature of silk and wool, and that of cotton and flax; but they contain all the information which chemistry at present is able to furnish. We shall now state, in the following sections, the differences which have been observed in the mechanical structure of these different substances.

SECT. I.—Of Wool.

Wool, which is well known as the covering of sheep, derives its value from the length and fineness of its filaments. The filaments of wool are considerably elastic, for they may be drawn out beyond their usual length, and when the force is removed, they recover it again. The surface of the filaments of wool or hair is not perfectly smooth; for although no roughness or inequality can be discovered by the microscope, yet they seem to be formed of small laminae placed over each other in a slanting direction, from the root of the filament towards its point, resembling the arrangement of the scales of a fish, which cover each other from the head of the animal to its tail; or perhaps they consist of zones placed over each other,

Structure.

Substances as is observed in the horns of animals. This peculiarity of structure of the filaments of hair and wool is proved by a simple experiment. If a hair be laid hold of by the root in one hand, and drawn between the fingers of the other hand, from the root towards the point, scarcely any friction or resistance is perceived, and no noise is heard; but if it be grasped by the point, and passed in the same manner between the fingers from the point towards the root, a resistance is felt, and a tremulous motion is perceptible to the touch, while the ear is sensible to a slight noise. Thus it appears, that the texture of the surface of hair or wool is not the same from the root towards the point, as it is from the point towards the root. This is further confirmed by another experiment. If a hair be held between the thumb and fore finger, and they are rubbed against each other in the longitudinal direction of the hair, it acquires a progressive motion towards the root. This effect depends not on the nature of the skin of the finger, or on its texture, for if the hair be turned, and the point placed where the root formerly was, the motion is reversed, that is, it will still be towards the root.

Felting. On this peculiarity of structure, which was observed by M. Monge, depend the processes of felting and fulling, to which hair and wool are subjected for different purposes. In the process of felting, the flocculi of wool are struck with the string of the bow, by which the filaments are separately detached, and dispersed in the air. These filaments fall back on each other in all directions on the table, and when a layer of a certain thickness is formed, they are covered with a cloth, on which the workman presses with his hands in all parts. By this pressure the filaments of wool are brought nearer to each other; the points of contact are multiplied; the progressive motion towards the root is produced by the agitation; the filaments entangle each other; and the laminæ of each filament taking hold of those of the other filaments, which are in an opposite direction, the whole is retained in the state of close contexture.

Fulling. Connected with this operation is that of fulling. The roughness on the surface of the filaments of wool, and their tendency to acquire a progressive motion towards the root, produce considerable inconvenience in the operations of spinning and weaving. These inconveniences are obviated by covering the filaments with a coat of oil, which fills up the cavities, and renders the asperities less sensible. When these operations are finished, the stuff must be freed from the oil, which would prevent it from taking the colour with which it is to be dyed. For this purpose it is taken to the fulling-mill, where it is beaten with large beetles, in a trough of water, through which clay has been diffused. The clay unites with the oil, which being thus rendered soluble in the water, is carried off by fresh portions of water, conveyed to it by proper apparatus. In this way the stuff is scoured; but this is not the sole object of the operation. By the alternate pressure of the beetles, an effect similar to that of the hands in the operation of felting is produced. The filaments composing a thread of warp or woof, acquire a progressive motion, are entangled with the filaments of the adjoining threads, those of the latter into the next, and so on, till the whole threads are felted together. The stuff is now contracted in all its dimensions, and, participating both of the nature of cloth and of felt, may be cut without being subjected to ravel; and, when employed to make a garment, requires no hemming. In a common woollen stocking web, after this operation, the stitches, when one

happens to slip, are now no longer subject to run, and the threads of the warp and woof being less distinct from each other, the whole stuff is thickened, and forms a warmer clothing.

The various manufactures of which wool constitutes the basis are justly regarded as among the most important to man in civilized society. Accordingly, the production of fine wool, and the causes which retard or improve the breed of sheep from which it is obtained, have greatly occupied the attention of economists and philosophers in our own, as well as in other countries. The wool of different breeds of sheep, in different countries, it is well known, possesses very different qualities, both with regard to the fineness of the filament, and the colour. Some is of a white or yellow, and some of a reddish and black colour. Excepting the wool of the breed of sheep in Andalusia, the Spanish wool was formerly all of a brownish-black colour. This was preferred by the native Spaniards; and even at this day, the dress of some religious orders in Roman Catholic countries consists of cloth manufactured from this wool, and retaining its natural colour. But for the purposes of dyeing, white wool is now always preferred, because it is found susceptible of receiving better and more durable colours.

Wool is naturally covered with a kind of grease or oil, which is found to preserve it from insects or moths, and on this account this greasy matter is not removed, or the wool is not scoured, till it is to be dyed or spun.¹ The process for scouring wool is the following: It is put for about a quarter of an hour into a kettle, with a sufficient quantity of water, to which a fourth part of putrid urine has been added. It is then heated to such a degree as the hand can bear, occasionally stirred, and, after being taken out, is allowed to drain. It is then put into a basket, and exposed to a stream of running water, and moved about till the grease is so completely separated that it no longer renders the water turbid. After being drained, it is sometimes found to lose by this operation above one fifth of its weight. It is almost unnecessary to observe, that the more carefully and completely this process is performed, the better the wool is fitted to receive the colouring matter. Our chemical readers will readily perceive the nature of the changes which are effected in this process of scouring. The ammonia, or volatile alkali, which exists in the urine, combines with the oil of the wool, and forms a soap, which being soluble in water, is dissolved and carried off.

Wool is either dyed in the fleece, or after it is spun into threads, or when it has been manufactured into cloth. For the purpose of forming cloths of mixed colours, it is dyed before it is spun; for the purposes of tapestry, it is dyed in the state of thread; but most commonly it is subjected to this process after it has been manufactured into cloth. In these different states the quantity of colouring matter which is taken up is very different. The proportion is largest when it is dyed in the fleece, because then the filaments being more separated, a greater surface is exposed to the action of the colouring particles. For a similar reason the quantity of colouring matter taken up is greater when in the state of thread or yarn, than when it is formed into cloth. But cloths themselves must vary greatly in this respect, according to their different qualities. Their different degrees of fineness, or closeness of texture, will produce considerable variations; and besides, the difference in the quantity and dimensions of the substances to be dyed, the different qualities of the ingredients employed in the process, and the different circum-

¹ According to an observation of Reaumur, rubbing any stuff with greasy wool is sufficient to preserve it from moths.

stances in which it is performed, should be a caution against trusting to precise quantities, regulated by weight or measure, which are recommended according to general rules. According to the fineness of the texture of the wool, and the nature of the colouring matter employed, it is found to be more or less penetrated with this matter. The coarse wool from the thighs and tails of some sheep receives colours with difficulty, and the finest cloth is never completely penetrated with the scarlet dye. The interior of the cloth appears always, when cut, of a lighter shade, and sometimes even white.

SECT. II.—Of Silk.

Origin.

Silk, which forms the basis of one of the richest and most splendid parts of dress among the wealthy and luxurious in civilized society, is the production of different species of insects. The *phalæna bombyx*, or silk-worm, which is a native of China, attracted the attention of mankind in that country from the earliest ages. The honour of having first collected and prepared silk from the cocoons or balls in which it is wound up by the insect, during its metamorphosis, is ascribed by the Chinese historians to the wife of an emperor. The *phalæna atlas*, Lin. which is also a native of China, is said to form larger cocoons, and to yield a stronger silk. The silk-worm was first carried from China to Hindustan, and afterwards to Persia. Silk seems not to have been known to the Greeks or Romans till the time of Augustus. Its nature and origin were little understood; and for many ages it was so scarce that it could only be purchased at a price which was equal to its weight in gold. The emperor Aurelian, it is said, from a principle of economy, resisted the urgent solicitations of his empress, who wished to have a silken robe, alleging the extravagance of the expense. About the middle of the sixth century, two monks returned from India to Constantinople, and brought with them a considerable number of silk-worms, with instructions for managing and breeding them, as well as for collecting, preparing, and manufacturing the silk. Establishments were thus formed at Corinth, Athens, and other parts of Greece. The crusades, which greatly contributed to the diffusion of different kinds of knowledge, by the intercourse which took place between different countries, proved useful in disseminating the knowledge of rearing the silk-worm, and preparing and manufacturing its valuable productions. Roger, king of Sicily, about the year 1130, returning from one of these frantic expeditions, brought with him from Athens and Corinth several prisoners, who were acquainted with the management of silk-worms and the manufacturing of silk. Under their superintendence manufactories were established at Palermo and Cagliari in Sicily. This example was soon adopted and followed in different parts of Italy and Spain. In the time of James I. an attempt was made to establish the silk-worm in England. For this purpose the culture of the mulberry-tree, on which the insects feed, was strongly recommended by that prince to his subjects; but the attempts which were made have been hitherto unsuccessful.

Scouring.

The fibres of silk are covered with a coating or natural varnish of a gummy nature. To this are ascribed its stiffness and elasticity. Besides this varnish, the silk which is usually met with in Europe is impregnated with a substance of a yellow colour; and for most of the purposes to which silk is applied, it is necessary that it should be deprived both of the varnish and of the colouring matter. On this account it must be subjected to the operation of scouring; but for silks which are to be dyed this process should not be carried so far as for those which are merely

to be whitened; and different colours, it is observed, require different degrees of this operation. The quantity of soap constitutes the chief difference. A hundred pounds of silk boiled in a solution of twenty pounds of soap for three or four hours, adding new portions of water during the evaporation, are sufficiently prepared for receiving common colours. For blue colours, the proportion of soap must be increased; and scarlet, cherry colour, &c. require a still greater proportion, for the ground must be whiter for these colours.

Silk which is to be employed white must undergo three operations. In the first the hanks are immersed in a hot but not boiling solution of thirty pounds of soap to a hundred of silk. When the immersed part is freed from its gum, which is known by its whiteness, the hanks are shaken over, as the workmen term it, so that the part which was not previously immersed may undergo the same operation. They are then wrung out as the process is completed. In the second operation the silk is put into bags of coarse cloth, each bag containing twenty or thirty pounds. These bags are boiled for an hour and a half in a solution of soap prepared as before, but with a smaller proportion of soap; and, that they may not receive too much heat by touching the bottom of the kettle, they must be constantly stirred during the operation. The object of the third operation is to communicate to the silk different shades, to render the white more agreeable. These are known by different names, as China-white, silver-white, azure-white, or thread-white. For this purpose a solution of soap is also prepared, of which the proper degree of strength is ascertained by its manner of frothing by agitation. For the China-white, which is required to have a slight tinge of red, a small quantity of anotta is added, and the silk is shaken over in it till it has acquired the shade which is wanted. In other whites a blue tinge is given by adding a little blue to the solution of soap. The azure-white is communicated by means of indigo. To prepare the azure, fine indigo is well washed two or three times in moderately warm water, ground fine in a mortar, and boiling water poured upon it. It is then left to settle, and the liquid part only, which contains the finer and more soluble parts, is employed.

Some use no soap in the third operation; but when the second is completed, they wash the silks, fumigate with sulphur, and azure them with river water, which should be very pure. But all these operations are not sufficient to give silk that degree of brightness which is necessary, when it is to be employed in the manufacture of white stuffs. For this purpose it must undergo the process of sulphuration, in which the silk is exposed to the vapour of sulphur; for an account of which see BLEACHING. But before the silk which has been treated in this way is fit for receiving colours, and retaining them in their full lustre, the sulphur which adheres to it must be separated by immersion and agitation for some time in warm water, otherwise the colours are tarnished and greatly injured.

It has long been an object of considerable importance to deprive silk of its colouring matter, without destroying the gum, on which its stiffness and elasticity depend. A process for this purpose was discovered by Beaumé, but as it was not made public, others have been led to it by conjecture and experiment. The following account, given by Berthollet, is all that has transpired concerning this process. A mixture is made with a small quantity of muriatic acid and alcohol. The muriatic acid should be in a state of purity, and particularly should be entirely free from nitric acid, which would give the silk a yellow colour. In the mixture, thus prepared, the silk is to be immersed.

One of the most difficult parts of the process, espe-

Substances to be coloured.

Process when employed white.

Mode of extracting its colouring matter.

Substances to be coloured. cially when large quantities are operated upon, is to produce a uniform whiteness. In dyeing the whitened silk, there is also considerable difficulty to prevent its curling, so that it is recommended to keep it constantly stretched during the drying. The muriatic acid seems to be useful in this process, by softening the gum, and assisting the alcohol to dissolve the colouring particles which are combined with it. The alcohol which has been impregnated with the colouring matter may be again separated from it and purified, that it may serve for future operations, and thus render the process more economical. This may be done by means of distillation, with a moderate heat, in glass or stoneware vessels.

Aluming. The preparation with alum is a very important preliminary operation in the dyeing of silk. Without this process few colours would have either beauty or durability. Forty or fifty pounds of alum, previously dissolved in warm water, are mixed in a vat with forty or fifty pailfuls of water; and to prevent the crystallization of the salt, the solution must be carefully stirred during the mixture. The silk being previously washed and beetled, to separate any remains of soap, is immersed in this alum liquor, and at the end of eight or nine hours is wrung out, and washed in a stream of water. A hundred and fifty pounds of silk may be prepared in the above quantity of liquor; but when it begins to grow weak, which may be known by the taste, twenty or twenty-five pounds of dissolved alum are to be added, and the addition repeated till the liquor acquires a disagreeable smell. It may then be employed in the preparation of silk intended for darker colours, till its whole strength is dissipated. This preparation of silk with alum must be made in the cold; for when the liquor is employed hot, the lustre is apt to be impaired.

SECT. III.—Of Cotton.

Origin. Cotton is the down or wool contained in the pods of a shrubby plant, which is a native of warm climates. Of this genus of plants (*Gossypium*, Lin.) there are four species, one of which only is perennial; the other three are annual plants; but of these there are many varieties, occasioned by the difference of soil or temperature in which they are produced. The principal differences among cottons consist in the length and firmness of the filaments, and in their strength and colour.

Structure. The peculiar structure of the fibres of cotton is not well known. According to the microscopic observations of Leeuwenhoeck, they have two sharp sides, to which are ascribed the irritation and inflammation of wounds and ulcers when they are dressed with cotton instead of lint. This peculiarity of structure, it is also supposed, may occasion some difference in the conformation and number of the pores, on which alone the disposition of cotton to admit and retain colours better than linen seems to depend. In this respect, however, it is inferior to wool and silk, because, on account of its vegetable nature, its affinity for colouring matter is less powerful.

Has a less affinity than wool for colouring matter. It is well known that silk, cotton, and linen have a weaker affinity for colouring matter than wool. Le Pileur d'Apligny attempts to explain this by supposing that the pores of these substances are smaller than those of wool, and that the colouring particles enter them less easily and freely. But according to the observation of Dr Bancroft, the reverse of this seems to be the fact; for there is little difficulty in making silk, cotton, and linen imbibe colouring matter, even when it is applied cold, without any artificial dilatation of the pores, which is always necessary in

the dyeing of wool. The only real difficulty is to make them retain the colours after the matter has been imbibed; because being admitted so readily into their undilated pores, the particles cannot be afterwards compressed and retained by the contraction of these pores, as is the case with wool. It requires double the quantity of cochineal which is necessary for wool to communicate a crimson colour to silk; a certain proof that it can take up a greater quantity, and consequently that the pores are sufficiently large and accessible. Unbleached cotton is always preferred for dyeing Turkey red, because in this state the colour is found to be most permanent; and this is ascribed to the pores or interstices being less open than after it has undergone the process of bleaching. The same thing is observed of raw or unscoured silk. It is found to combine more easily with the colouring matter, and to receive a more permanent colour in this state, than after it has been scoured and whitened. "The openness of cotton and linen," says Dr Bancroft, "and their consequent readiness to imbibe both colouring particles and the earthy or metallic bases employed to fix most of them, are circumstances upon which the art of dyeing and calico-printing is in a great degree founded."¹ But is not this too mechanical an explanation of the phenomenon? Might it not rather be alleged that it is owing to a difference of affinities which exists between the particles of colouring matter and the substance which is separated from the silk or cotton by the process of bleaching or scouring? This substance probably acts the part of a mordant; and having a stronger affinity for the stuff and for the colouring matter than the stuff has for the latter, the colour communicated is more durable when silk or cotton is dyed in the unbleached or unscoured state.

To prepare cotton stuffs for receiving the dye, several operations are necessary. It must first undergo the process of scouring. By some it is boiled in sour water, or in alkaline ley. It should be kept boiling for two hours, then wrung out, and rinsed in a stream of water till the water comes off clear. The stuffs to be prepared should be soaked for some time in water, mixed with not more than $\frac{1}{30}$ th part of sulphuric acid, and then carefully washed in a stream of water, and dried. In this operation the acid combines with a portion of calcareous earth and iron, which would have interrupted the full effect of the colouring matter in the process of dyeing.

Aluming is another preliminary process in the dyeing of cotton. The alum is to be dissolved in the manner already described in preparing silk. Each pound of cotton stuff requires four ounces of alum. By some a solution of soda, about $\frac{1}{16}$ th part of the alum, and by others a small quantity of tartar and arsenic, are added. The thread is to be impregnated by working it in small quantities with this solution. The whole is then put into a vessel, and the remaining part of the liquor is poured upon it. In this state it is left for twenty-four hours, after which it is removed to a stream of water, and allowed to remain for an hour and a half, or two hours, to extract part of the alum. It is then to be washed. By this operation cotton is found to gain an addition of about $\frac{1}{40}$ th part of its weight.

The operation of galling is another preparatory process in the dyeing of cotton stuffs. The quantity of astringent matter employed must be proportioned to its quality, and the amount of the effect required. Powdered galls are boiled for two hours in a proportion of water, regulated by the quantity of thread to be galled. This solution being reduced to such a temperature as the hand can bear, is

¹ *Philosophy of Permanent Colours*, p. 71.

Substances divided into a number of equal parts, that the thread may be wrought pound by pound. The whole stuff is then put into a vessel, and the remaining liquor poured upon it, as in the former process. It is then left for twenty-four hours if it is to be dyed black, but for other colours twelve or fifteen hours are found sufficient. It is then wrung out and dried.

In the galling of cotton stuffs, which have already received a colour, the precaution should be observed of performing this operation in the cold, otherwise the colour is subject to injury.

Berthollet informs us, that cotton which had been alumed acquired more weight in the galling than that which had not previously undergone that process; for although alum adheres but in small quantities to cotton, it communicates to it a greater power of combining both with the astringent principle and with the colouring particles. This, we may add, may be considered as a good instance of the action of intermediate affinities, and of the advantage to be derived to the art of dyeing, from investigating and observing this action.

SECT. IV.—Of Flax.

Origin. Flax and hemp nearly resemble each other in their general properties; and, so far as relates to the process of dyeing, what is said of the one may be applied to the other. Flax or lint is obtained from the bark of *Linum usitatissimum*, and hemp from that of *Cannabis sativa*.

Watering. Before flax is properly prepared to receive the dye, it must be subjected to several processes. One of the most important is that of watering, by which the fibrous parts of the plant are separated, and brought to that state in which they can be spun into threads. As the quantity and quality of the product depend much on this preliminary operation, it becomes of the greatest consequence that it be properly conducted. During this process carbonic acid and hydrogen gas are given out. The extrication of these gases is owing to a glutinous juice, which holds the green colouring part of the plant in solution, and which is the medium of union between its cortical and ligneous parts, undergoing a certain degree of putrefaction. This substance seems to resemble the glutinous part, which is held dissolved in the juice obtained from plants by pressure; is separated from the colouring particles by means of heat; readily becomes putrid; and by distillation affords ammonia. But although it is held in solution with the expressed juice, it would appear that it cannot be separated from the cortical parts completely by means of water; and hence it happens that hemp or flax watered in too strong a current has not the requisite softness and flexibility. But, on the other hand, if the water employed in this operation be stagnant and in a putrid state, the hemp or flax becomes of a brown colour, and loses its firmness. In the one case the putrefactive process is interrupted; in the other it is continued too long and carried too far. This process, therefore, is performed with the greatest advantage in places near the banks of rivers, where the water may be changed so frequently as to prevent such a degree of putrefaction as would be injurious to the flax, as well as prejudicial to the workmen, from noxious exhalations; and at the same time not so frequently as to retard or interrupt those changes which are necessary for rendering the glutinous substance soluble in water.

By the process of watering flax, and by drying before and after that process, the green-coloured particles undergo a similar change to that which is observed in the green substance of the plants exposed to the action of air and light. The next part of the process, therefore, after watering, is to spread it out upon the grass, and thus expose it

for some time to the air and sun. By this means the colour of the lint is improved, and the ligneous part becomes so brittle that it is easily separated from the fibrous part. This operation, as is well known, is usually performed by machinery.

The fibres of lint possess no perceptible degree of elasticity, and they appear to be perfectly smooth. No roughness or inequality can be detected by the feel, and no asperities can be perceived, even with the assistance of the microscope. Experience shows, that it produces no irritation on wounds or sores which are dressed with it, as is known to happen from a similar application of cotton stuffs.

Flax which is intended for dyeing must be subjected to a similar series of operations with cotton, in the different processes of scouring, aluming, and galling. A repetition of the mode of performing these operations is therefore unnecessary.

CHAPTER III.

OF MORDANTS.

The term mordant is applied by dyers to certain substances with which the cloth to be dyed must be impregnated, otherwise the colouring matters would not adhere to the cloth, but would be removed by washing. Thus the red colour given to cotton by madder would not be fixed, unless the cloth were previously steeped in a solution of a salt of alumina. It has been ascertained that the cloth has the property of decomposing the salt of alumina, and of combining with and retaining a portion of alumina. The red colouring principle of the madder has an affinity for this alumina, and combines with it. The consequence is, that the alumina being firmly retained by the cloth, and the colouring matter by the alumina, the dye becomes fast, or cannot be removed by washing the cloth with water, even by the assistance of soap, though simple water is sufficient to remove the red colouring matter from the cloth, unless the alum mordant has been previously applied.

The term *mordant* (from the Latin word *mordere*, to bite) was applied to these substances by the French writers on dyeing, from a notion entertained by them that the action of the mordants was mechanical; that they were of a corrosive or biting nature, and served merely to open pores in the fibres of the cloth, into which the colouring matter might insinuate itself. And after the inaccuracy of this notion was discovered, and the real use of mordants ascertained, the term was still continued, as sufficiently appropriate, or rather as a proper name, without any allusion to its original signification.

The term *mordant*, however, is not limited to those substances merely which serve, like alumina, to fix the colours. It is applied also to certain substances, which have the property of altering the shade of colour, or of brightening the colour, as it is called. Thus *cream of tartar* is usually called a mordant, because when chloride of tin is used, as is the case in the red dye upon silk or woollen, the addition of cream of tartar is necessary, not merely to brighten the colour, but to cause its equable application upon the cloth; for when the tartar is omitted, we observe that the shade is very unequal upon different parts of the surface, some spots being much darker and some much lighter than others. We believe that tartar acts chiefly, if not entirely, by forming a double salt with the chloride of tin, from which the tin is not liable to be partially precipitated. The consequence of this is, the equal distribution of the tin through the whole liquid, and the consequent equality of its application on the cloth. For the

Mordants. depth of the shade depends upon the proportion of tin fixed upon the cloth. Berthollet has proposed to distinguish those substances which are employed to alter the shade of colour from the mordants strictly so called, by giving them the name of *alterants*.

The mordants employed by dyers are but few in number. Alumina, the oxides of tin, the protoxide of lead, the black oxide of copper, and the infusion of nutgalls, constitute almost the whole of them. The peroxide of iron and the sesquioxide of manganese have also a strong affinity for cloth, especially for cotton cloth, and are frequently employed; but they serve at once the purpose of mordants and colouring matters. We believe also that in one important process for giving a fine red to cotton, what is usually called the *Turkey-red dye*, the *margarate of potash* constitutes an indispensable mordant.

Let us take a view of these different mordants in succession.

1. *Alumina*.—This is a soft, white, tasteless powder, insoluble in water, but soluble in acids, and constituting sweet-tasted and astringent salts, which have the property of reddening vegetable blues. These salts are soluble in water, but very few of them are capable of crystallizing. Of all the salts of alumina, the most important is *alum*, the nature and properties of which have been described in another part of this work. See ALUM

How used. It is a double salt, composed of three integrant particles of sulphate of alumina united to one integrant particle of sulphate of potash or sulphate of ammonia and twenty-five integrant particles of water. The ammoniacal alum is less soluble in cold water than the potash alum; but both kinds are sufficiently soluble in hot water. Such is the affinity of alumina for woollen or silk stuffs, that when they are plunged into a solution of alum, the alumina leaves the sulphuric acid with which it was united, and combines with the fibres of the cloth. The affinity of alumina for cotton or linen, though considerable, is not so great as its affinity for wool or silk. On that account the cotton dyers and calico printers find it requisite to combine the alumina, before using it as a mordant, with a weaker acid than the sulphuric. The *acetic* is the one which has been made choice of, and the acetate of alumina is prepared by the following process: Three parts of alum and one part of acetate of lead are dissolved in eight parts of hot water. There is then added one eighth of a part of potash and as much chalk. The reason of the addition of the potash and the chalk is, that one part of acetate of lead is not sufficient to decompose three parts of alum. These substances prevent the residual alum from crystallizing, by decomposing it. The proper quantities of these salts which the dyers ought to employ are six parts of alum and seven parts of sugar of lead. These proportions would just convert the sulphate of alumina of the alum into acetate of alumina, without altering the sulphate of potash.

The wool or silk is put into a hot solution of alum, and the cotton into a hot solution of acetate of alumina, and passed through the liquid till a sufficient quantity of the alumina has combined with the fibres of the cloth. It is then wrung out, washed, and dried. The alumina remains firmly adhering to the cloth, and cannot be removed by washing, bleaching, or any of the processes to which such cloths are usually subjected.

Quantity of alumina which adheres to cotton. In order to form some notion of the quantity of alumina fixed upon cloth by the aluming process, the writer of this article made the following experiments: A quantity of cotton cloth was procured, such as is sometimes used for making light dresses of Turkey red. Of this, 1000 grains were burnt, and the ashes being reserved and analyzed, were found to contain 0.4 grain of alumina. 1000 grains of the same cloth which had been dyed Turkey red, and

of course subjected to the aluming process, were burnt, and the ashes subjected to a chemical analysis. The alumina contained in them weighed eight grains. Hence 7.6 grains of this matter had combined with the cloth in the process of aluming.

The length of 1000 grains of the undyed cotton cloth was one yard five and two-third inches, and its breadth thirty-three inches. The length of 1000 grains of the Turkey red cloth was one yard and six inches, with a breadth of thirty-three inches. The two pieces of cloth, therefore, were very nearly of a size. We see that the dyed cloth had been stretched a very little during the processes to which it had been subjected. Thus it appears that a surface of cloth amounting to 1386 square inches, or rather 2772 square inches (as both sides of the cloth had been equally subjected to the aluming process), had combined with 7.6 grains of alumina, or every square inch of the cloth had combined with 0.0027 grains ($\frac{1}{370}$ th grain nearly) of alumina. Small as this quantity may appear, it was sufficient to fix the red colouring principle of madder, and to constitute a very deep and beautiful dye.

A very pale shade of red is sometimes given to a portion of the cloth, which has a beautiful effect when contrasted with the deep Turkey-red dye. This is produced by limiting the quantity of alumina applied to the parts which are to be light red. In fact, no alum mordant whatever is applied to the parts which are to be light red; but they get a little during the steps taken to remove the excess of aluminous mordant, which has been applied to the parts that are to get the deep-red colour.

To ascertain the quantity of alumina which was sufficient to fix the light-red colour, the writer of this article got a portion of the same cotton cloth formerly operated on, dyed of the light-red colour. 1000 grains of this cloth being burnt, and the ashes analyzed, were found to contain 0.8 grain of alumina. Subtracting the 0.4 grain of alumina which 1000 grains of the undyed cloth contained, there remains 0.4 grain for the quantity communicated during the aluming process. These 1000 grains of cloth constituted a length of one yard and ten two-third inches. The breadth was thirty-two inches. Its surface (reckoning both sides) constituted 2986 $\frac{2}{3}$ square inches. So that every square inch of surface had combined with 0.00012 grains of alumina, or less than $\frac{1}{8000}$ th of a grain. Yet this quantity of alumina, small as it is, was essential to the permanence of the dye; for when unalumed cloth was dyed with madder, the colour was speedily and easily washed out by water; but the light-red Turkey-red dye was perfectly fixed.

These facts are sufficient to show us the very small size of a particle of alumina. Were only 1000 particles of this substance fixed upon the square inch of surface of cloth, the weight of a particle of alumina would not exceed the millionth part of a grain. But that the number far exceeds 1000 is evident from this, that when we examine the surface of the cloth with a microscope, the red colour does not appear in spots, but is equally spread over the whole cloth. Many thousand particles of alumina upon the square inch would be requisite to produce this effect.

The aluming and the dyeing are sometimes given to the cloth together; but more frequently the aluming precedes, and the dyeing follows after the cloth has imbibed the mordant and been washed and dried.

2. *Tin*.—Of all the metallic oxides, those of tin are the most useful as mordants. They form, with acids, salts very easily decomposed; and the fibres of cloth have an affinity so strong for these oxides, that they readily withdraw them from their saline combinations, and unite with them. Tin forms two different oxides with oxygen. The protoxide is black, but the peroxide is yellow, and sometimes also white.

Mordants. The tin mordants are formed by dissolving tin in muriatic acid. There are two chlorides of tin, as the combinations of that metal with chlorine are called. These are, the protochloride and the perchloride. The protochloride, when anhydrous, is a gray solid, with a pearly lustre; but when it is formed by dissolving tin in muriatic acid, it crystallizes in large oblique four-sided prisms, with one edge usually replaced by a tangent plane. The colour is white, with somewhat of the diamond lustre. The taste is acid, acrid, and disagreeable. When recently formed they dissolve in water; but when kept they dissolve imperfectly, leaving a white matter behind, which is an oxide of tin, and the quantity of this insoluble oxide increases with the age of the crystals.

How prepared as a mordant.

Calico-printers form their tin mordant by dissolving tin directly in muriatic acid; but the silk and woollen cloth dyers employ aqua regia for the purpose. Indeed tin for the dyers was originally dissolved in weak nitric acid; but when this method is followed, almost the whole tin precipitates in the state of an oxide in a few days. To prevent this precipitation, they added a little common salt or sal ammoniac to the nitric acid in which the tin was to be dissolved. Hellot informs us that Baron claimed the merit of having been the first person who employed aqua regia at Carcassone to dissolve tin. The object in view was to prevent the precipitation of the oxide, which always happens when nitric acid alone is used for that purpose.

The dyer's ordinary solution of tin is made with the kind of nitric acid called single *aqua fortis*. It is capable of dissolving about the eighth part of its weight of granulated tin. For each pound of aqua fortis it is usual to add about two ounces of common salt or sal ammoniac, and a little water to moderate the action of the acid. Those solutions which have been made most slowly, and with the least separation of fumes or vapours, have been found to succeed best; showing clearly that it is the protochloride of tin that constitutes the proper mordant. Two ounces of grain tin are usually allotted to every pound of aqua fortis. The metal should be added at different times, waiting till one part is nearly dissolved before another is added, otherwise too much heat may be evolved, which would cause the solution to go on too rapidly. The quantity of water added should be about one half of that of the aqua fortis used; so that the solution, when completed, should contain about one thirteenth of its weight of tin. About 20 lbs. of such a solution is required to die 100 lbs. of woollen cloth a full cochineal scarlet.

The process usually followed is this: Supposing 100 pounds weight of cloths intended to be died; ten pounds of cream of tartar are put into a suitable dyeing vessel of pure block tin,¹ with a sufficient quantity of clean soft water, and six or eight ounces of powdered cochineal. Immediately after this, ten or twelve pounds of the solution of tin are to be added, and when the mixture is nearly boiling hot, the cloth, previously completely wet, is put into the dyeing liquor, and turned through it by the winch, at first very rapidly, and afterwards slowly. This is to be continued for an hour and a half, after which the cloth is to be taken out and rinsed in clean water. By this first process the cloth has acquired a flesh colour. For the second or dyeing process the tin vessel is replenished with clean water. Five or six pounds of cochineal in powder are to be put into it, and well mixed by stirring it for a few minutes. After this the remaining part of the solution of tin is to be added; and the whole being well stirred, the cloth is to be

put into the liquor, and turned very briskly through it, that both ends may receive an equal portion of the dye. After this it is turned more slowly for the space of half an hour, or until the dyeing liquor becomes exhausted, when the cloth is to be taken out, aired, and rinsed.

The process followed by the calico-printers for preparing the tin mordant is to dissolve tin in muriatic acid, by which a protochloride of tin is obtained. But Dr Bancroft found that, when a saturated solution of tin in muriatic acid was employed for dyeing woollen cloth scarlet, it had a corrosive effect on the cloth. He recommends a mixture of nitric and muriatic acid as a good solvent; and doubtless such a mixture would be cheaper and better than a solution of common salt or sal-ammoniac in nitric acid. Dr Bancroft found that a mixture of sulphuric and muriatic acid made a good solvent for the tin. Some farther experiments are still wanting to elucidate the best state of the tin mordant for the scarlet dye. We are of opinion that it is the protochloride of tin that constitutes the true mordant;² but some addition seems necessary to enable the fibres of the cloth to separate the oxide of the tin from the combination in which it exists, or rather to unite with the muriatic acid, when it is formed and disengaged by the decomposition of water, which obviously takes place, otherwise this acid, when evolved, will exert a corrosive action on the cloth.

The tartar is necessary to produce the scarlet colour. Without it the colour of the cochineal dye is crimson, or at most a rose colour. It doubtless acts principally by forming a double salt with the chloride of tin. But it must also convert a portion of the cochineal into a yellow dye; for scarlet is a compound colour, consisting of a great deal of red, mixed with a small quantity of yellow.

3. *Lead*.—We are not aware of the protoxide of lead being employed in any case as a mordant in dyeing silks or woollen cloth; but of late years it has been used as a mordant for cotton, to which the beautiful yellow given by means of chromic acid was to be communicated. For this purpose the lead is dissolved in nitric acid, or converted into nitrate of lead. This salt crystallizes in octahedrons, has a sweet and astringent taste, and dissolves readily in water. An aqueous solution of it thickened by gum is applied to those parts of the cloth which are to receive a yellow colour; or if the cloth has been already dyed red, a quantity of tartaric acid is mixed with the solution of nitrate of lead and gum, and after it has been applied and dried on the cloth, the piece is passed through water impregnated with a quantity of bleaching powder. The red colour is discharged; but the oxide of lead, which had united with the fibres of the cloth, still continues to adhere without alteration. The cloth is now passed through a solution of bichromate of potash. Those parts of it which contained the oxide of lead immediately decompose the bichromate; chromate of lead is formed and fixed upon the cloth, constituting a most beautiful and indelible yellow colour; or, by particular alterations in the process, this yellow colour may be changed to red, or to a very deep orange approaching red, and exceedingly beautiful.

4. *Copper*.—The black oxide of copper is employed as a mordant in giving a black colour to hats, or at least acetate of copper is employed in the process; and it is not easy to conceive any other purpose which such a salt can serve than contributing a portion of oxide of copper to act as a mordant.

5. *Galls*.—Nutgalls are excrescences which grow on

¹ Copper vessels are found to injure the colour, and therefore are not used.

² We do not mean that the protoxide of tin remains fixed on the cloth: it doubtless becomes peroxide. But the superior solubility of protochloride of tin fits it better for the purpose.

Mordants. the branches of some species of oak, in consequence of the puncture of an insect, the *cynips quercus folii*. The best kind come from the Levant. They are nearly spherical bodies, with protuberances on the surface. There is a cavity within where the insect lodged, and a round hole from that central cavity to the surface, by which the insect, after it was hatched from the deposited egg, eat its way out. These nutgalls have a very astringent and austere taste. When digested in water they give that liquid a brown colour, and the taste which they themselves have. When such an infusion is mixed with a solution of sulphate of iron, it strikes a deep blue or black colour. Nutgalls, besides a considerable portion of woody fibre, contain a notable quantity of two peculiar vegetable substances, to which they owe their value as dyestuffs or mordants. These are *tannin* and *gallic acid*. The latter of these substances is easily obtained in a state of purity; the former with difficulty.

Contains tannin The infusion of nutgalls contains scarcely any thing else than a solution of tannin and gallic acid. If we evaporate the solution in a gentle heat to dryness, and digest the residue in sulphuric ether or absolute alcohol, the gallic acid will be dissolved, and the tannin will remain in a state of tolerable purity, only coloured brown by the action of the air. Tannin, when pure, is white while moist. It becomes yellow when dried even *in vacuo*, and by subsequent exposure to the air it becomes darker coloured. Its taste is excessively astringent and harsh; and it is distinguished by the property of striking a deep blue or black with the salts of iron. Tannin is easily altered in its nature by heat. Its constitution, as determined by the experiments of Berzelius, is as follows:

Carbon.....	52.69 to 52.49
Hydrogen.....	3.86 to 3.79
Oxygen.....	43.45 to 43.72
	100.00 100.00

This corresponds best with

7 atoms carbon.....	5.25
3 atoms hydrogen.....	0.375
4½ atoms oxygen.....	4.333
	9.958

Hence it is either composed of these atoms or of some multiple of them, most probably of

21 atoms carbon.....	15.75
9 atoms hydrogen.....	1.125
13 atoms oxygen.....	13.00
	29.875

This would make its atomic weight 29.875.

Tannin exists not merely in nutgalls, but in oak bark, in the wood of the oak, in the leaves, and in fact in every part of that tree; but the quantity of it is much greater in nutgalls than in any other part.

Tannin possesses the characters of an acid. It reddens vegetable blues, effervesces with the carbonates, and unites in definite proportions with the bases.

and gallic acid.

Gallic acid exists also as a constituent of nutgalls, and may be extracted from them by means of ether or absolute alcohol. Its colour is white, though it is apt, like tannin, to become yellow when exposed to the atmosphere, and seems indeed capable of being converted into tannin by exposure to too high a temperature. It is not nearly so soluble in water as tannin, and is distinguished by an acid taste instead of an astringent one. Like tannin, it strikes a black with the salts of iron. But the gallate of iron is readily distinguished from the tannate. The former is an exceedingly fine black powder, which precipitates very slowly, while the latter is a deep blue, which

precipitates rapidly, has a coarse appearance, and becomes black when dry. The constituents of gallic acid, according to the analysis of Berzelius, are as follows:

Carbon.....	56.64
Hydrogen.....	5.00
Oxygen.....	38.36
	100.00

This corresponds with

7½ atoms carbon.....	5.625
4 atoms hydrogen.....	0.5
4 atoms oxygen.....	4.0
	10.125

Or, if we double the quantities to get rid of the half atom,

15 atoms carbon.....	11.25
8 atoms hydrogen.....	1.00
8 atoms oxygen.....	8.00
	20.25

In gallic acid the hydrogen and oxygen exist in the proportions which constitute water; but in tannin there is a surplus of oxygen. In gallic acid there is rather more hydrogen than in tannin.

The great use to which the infusion of nutgalls is put in dyeing is to give a black colour when mixed with solution of sulphate of iron. When used in this way it perhaps is improperly named a mordant; for the oxide of iron is known to have a strong affinity for the fibres of cloth, and the tannin and gallic acid have a strong affinity for the oxide. Hence probably the way in which the black dye is fixed on silk and woollen cloth. There can be no doubt that the tannin, which is by far the most abundant ingredient, is the principal agent in striking the black with the sulphate of iron. But the gallic acid probably adds to the lustre, and improves the beauty of the colour.

In the Turkey-red process for giving a fixed red colour to cotton cloth by means of madder, steeping the cloth in infusion of nutgalls is an important part of the process, as without this the colour would be apt to want equality of shade in different parts of the cloth. In this process there can be no doubt that tannin acts the part of a mordant. The galling, in preparing the cloth for the Turkey-red dye, always precedes the alumina process. Whether it has the property of making the alumina more fixed on the cloth than it otherwise would be, or what other purpose it may serve, is not very well understood; but it is certain that the boiling of the cloth in a pretty strong infusion of galls is important. The infusion of galls is made by boiling twenty-five pounds of nutgalls in forty gallons of water, till four or five gallons are boiled or evaporated. The specific gravity of the infusion is 1.020; or sometimes the process is twice repeated, employing each time only twelve and a half pounds of nutgalls in forty gallons of water. The specific gravity of each infusion in that case is only 1.010.

Such is an account of the mordants at present employed in dyeing, and the way of using them. It is not always necessary to employ mordants in dyeing; some colouring matters adhere to the cloth without the presence of any intermediate substance. This is the case with the oxides of iron and manganese. It is the case also with indigo, and it was the case also with the colouring matter from the buccinum and purpura employed by the ancient Phœnician dyers in dyeing the celebrated purple, of which an account has been given in the first chapter of this treatise. To those colouring matters which adhere to the cloth of themselves Bancroft has given the name of *substantive* colours, while he distinguishes those that require a mordant by the name of *adjective* colours.

Mordants.
Effects of
mordants
on the co-
lour.

Mordants have a very considerable effect on the colour; and by varying the mordant, very different colours, and a great variety of shades, may be obtained from the same colouring matter. Some mordants themselves may be considered as communicating a colour, without the addition of any colouring substance; and although, when the latter is added, a new set of affinities is brought into action, yet there is little doubt that the mordant also has a considerable share in fixing the shades of colour. Let us take an example in dyeing with cochineal. When the aluminous mordant is employed, the colour produced is crimson; but when the oxide of iron is substituted for the alumina, the colour obtained is black. The effect is obviously produced by a change in the action of the affinities between the colouring matter and the mordant, and the colouring matter and light. In the use of mordants, therefore, it is necessary to attend to their combined effects with the colouring matter employed, and, to be able to communicate particular colours to stuffs with any degree of certainty, to know the amount of that effect.

Even in the mode of applying mordants, the variety of shades may be greatly multiplied. Different effects, for instance, are produced by previously impregnating the stuff with the mordant, or by mixing it with the bath. Different effects also arise from using heat, or as the stuff is more or less rapidly dried; and this must appear to be the case, if we consider the different affinities which are in action, and the change on the action of these affinities in these different circumstances, as well as in others which can scarcely be appreciated. The combination of these substances which have an affinity for the stuff, and the decompositions which are the result of that combination, are greatly facilitated by the evaporation of the water or other liquid which held these substances in solution; because by its affinity, which is opposed to the action of the affinity between these substances and the stuff, the affinity of the latter produces a more limited effect. But in dyeing, the process should proceed slowly, that the substances may not be separated before their mutual affinities have begun to operate.

Considerable differences must be observed in the mode of employing the mordant, as the force of affinity between the stuff and the colouring matter is greater or less. When this affinity is strong, the mordant and the colouring substance may be mixed together; the compound thus formed immediately enters into combination with the stuff. But if the affinity between the stuff and the colouring particles be weak, the compound formed of the latter and the mordant may separate, and a precipitation take place, before it can be attached to the stuff; and hence it is in these cases that the mordant, which is to serve as the medium of union between the stuff and the colouring matter, must be combined with the former, before the application of the latter. It is from these differences that different processes must be followed in fixing colouring matters on animal and vegetable productions; as, for instance, in dyeing wool or silk black, or with cochineal.

In estimating the effects of mordants, and in judging of the most advantageous manner of applying them, it is necessary to attend to the combinations which may be formed, either by the action of the ingredients of which they are composed, or by that of the colouring matter and the stuff. It is necessary also to take into consideration the circumstances which may tend to bring about these combinations with more or less rapidity, or that may render them more or less perfect. The action which the liquor in which the stuff is immersed may have, either on its colour or texture, must also be considered; and, to be able accurately to judge of the extent of this action, we must know the proportions of the principles of which the mor-

dant is composed; which of these principles remains in an uncombined state in the liquor; and the proportion or quantity which is thus separated.

Simple
Colours.

CHAPTER IV.

OF THE MODE OF DYEING SIMPLE COLOURS.

Dyers have divided colours into two classes, namely, *simple* and *compound* colours. The *simple* are produced by a single dyeing process, and cannot be obtained by mixing together different colours. The compound colours are obtained by mixing together any two of the dyestuffs which produce the simple colours. By this means two colours are given to the cloth at once; and the shade depends upon the proportions of each dyestuff employed.

The simple colours are five in number; namely, *red*, *yellow*, *blue*, *black*, and *brown*. The last of these may be considered also as a compound colour, as it may be formed by mixing the dyestuffs for two simple colours together. The compound colours are *orange*, *green*, *purple*, and *gray*. We shall in this chapter confine ourselves to the mode of dyeing the simple colours, dividing it into five sections, in each of which we shall treat of a simple colour.

SECT. I.—Of Red.

In treating of the red dye, the simplest method seems to be to give an account, in the first place, of the dyestuffs employed for dyeing red; and in the second place, to describe the methods followed by the dyer to give a red colour to silk, wool, cotton, and flax.

I.—Description of the Dyestuffs.

The principal colouring matters used in dyeing red are *madder*, *cochineal*, *hermes*, *lac*, *archil*, *carthamus*, *Brazil wood*, and *logwood*.

1. *Madder* is the root of a plant, the *rubia tinctorum*, which is cultivated in the south of Europe. There are two varieties, the *rubia cordifolia* and the *rubia peregrina*. It is this last which is cultivated in the south of Europe, and comes to us from the Levant. The roots are wriery, and very much branched. They have a red colour externally, but are yellow within. This plant was cultivated by the Greeks and Romans, and was employed in medicine, and also in dyeing, as Dioscorides and Pliny inform us. It was called *erythrodamus* and *varantia* by the Greeks, and *rubia* by the Romans. From the last Greek name is derived the French word *garance*, by which madder is distinguished in that language.

It is the woody portion of madder that is useful in dyeing: the bark and pith are comparatively of little value. Madder has been examined by many chemists; but Robiquet and Colin alone have succeeded in separating the red colouring matter, and in determining its properties. They have distinguished it by the name of *alizarin*, an appellation derived from *alizari*, by which madder is distinguished in the Levant.

Madder contains two colouring matters; one, which is yellow, is soluble in cold water; the other, the *alizarin*, is soluble only in boiling water. To the yellow colouring matter Kuhlmann has given the name of *xanthin*. This matter considerably injures the colour of the *alizarin*; hence the reason why cloth dyed with madder has at first a dull brownish-red colour, which it loses in proportion as the *xanthin* is removed.

To obtain *alizarin*, Robiquet and Colin recommend the following process. Mix pounded madder with two thirds or with its own weight of concentrated sulphuric acid, and

Alizarin
how ob-
tained.

Simple Colours.

set the mixture aside for two or three days, taking care that heat is not evolved. All the other constituents of the madder, except the alizarin, are converted into charcoal; and should heat have been evolved, even the alizarin itself will be charred. Wash the black matter thus formed, to extract from it all the acid. What remains is a mixture of charcoal and alizarin. Let it be dried and digested with a portion of cold alcohol, which will dissolve a fatty matter which it contains. Let it now be digested in boiling alcohol till all the alizarin is dissolved. Mix the alcoholic solutions with water, distil off the alcohol, and filter the residual liquor. The alizarin remains upon the filter in a state of purity. Various other processes for extracting alizarin have been given by Robiquet and Colin, and by Kuhlmann and Zenneck.¹ But for these we refer to the respective publications of these chemists. The process which we have given we consider as of easiest execution.

Its properties.

Alizarin is insipid, and destitute of smell. According to Zenneck, it possesses weakly acid properties; but Colin and Robiquet consider it as perfectly neutral. It sublimes easily in long flexible capillary needles, having an orange colour; but unless the subliming vessels be very low and flat, much of the alizarin is decomposed during the process. Two watch-glasses applied to each other, for example, answer very well as a subliming vessel. During the process the alizarin gives out an aromatic odour like that of benzoin. It is almost insoluble in cold water; but it is moderately soluble in boiling water, to which it communicates a rose-red colour. At the temperature of 54°, 212 parts of alcohol, of the specific gravity 0.83, dissolve one part of alizarin. At the same temperature sulphuric ether, of specific gravity 0.73, dissolves $\frac{1}{160}$ th part of its weight of it. The alcoholic solution is red, that of ether yellow or orange. It is slightly soluble in bisulphide of carbon, oil of turpentine, naphtha, and the fat oils, communicating to these bodies a reddish-yellow colour. Chlorine has little action on it, yet it injures the colour a little, and makes it incline to yellow. Sulphuric acid dissolves it, and acquires at the same time a blood-red colour. Nitric and muriatic acid dissolve it, and slightly alter the shade of its colour. These acids, when dilute, do not dissolve it. With alkalis it forms soluble combinations, having a violet-red colour, which do not afford crystals. The alkaline carbonates dissolve it, assuming a violet colour. With the alkaline earths it forms precipitates, having a violet or lilac colour; with alumina a precipitate which is red or reddish-brown. With the metallic oxides it forms insoluble combinations, having a violet or reddish-brown colour.

It has a marked affinity for various animal matters. It dissolves in the white of an egg diluted with water; and if we coagulate the albumen by heat, the alizarin combines with it, leaving the liquid portion tinged yellow. Albumen, containing a portion of alizarin in solution, is precipitated by a solution of chloride of calcium; yet this salt does not precipitate uncombined albumen diluted with the same quantity of water. Phosphate of lime appears also to have a marked affinity for the colouring matter of madder. Indeed this is obvious, from the well-known fact, that the bones of animals which have taken for some time a quantity of madder mixed with their food, are tinged red.

Urine, when left in contact with madder, extracts from it the alizarin, and acquires a red colour, even when quite recent and acid. Milk is coloured yellow by madder, and red coagulated curd is deposited upon the madder. The solution of animal gelatin does not precipitate the red colouring matter of madder.

We are not aware that madder is employed in dyeing silk or wool, but it constitutes one of the most beautiful and fixed red dyes for cotton and linen, and for dyeing these substances it has been in use probably at least two thousand years. As the yellow colouring matter or *xanthin* is not used in dyeing, it seems unnecessary to give any account of it in this place.² It gives a very beautiful yellow colour, and might be employed in calico-printing, were it not that the extraction of it would cost too much money.

2. *Cochineal* is the name given to a small insect that inhabits the *cactus cocciniferus*, and three or four other species of cactus, upon which it remains immovable, drawing its nourishment from the juices of the plant. The insect is called by entomologists *coccus cacti*. It is the female insect (which is without wings) that constitutes the dyestuff. The insect is small, having a kind of hemispherical back, crossed by numerous wrinkles, and of a dark reddish-brown colour.

This insect is a native of Mexico, and had been employed by the natives as a red tinging matter. When the Spaniards entered that country in 1518 it drew their attention; and in 1523 Cortes received orders from the court of Spain to procure it in as great quantity as possible. He left the cultivation of the insect to the natives, who prosecuted it so successfully that great quantities of it were imported into Europe. The earlier Spanish writers described it as an insect, but at a later period it came to be considered as the seed of a plant; and this opinion continued the prevalent one, till the contrary was proved by Melchior de Ruuscher, about the beginning of the eighteenth century. This man, who was a native of Holland, affirmed in a society, from oral information which he had obtained in Spain, that cochineal was a small animal. Another person, whose name has not been made known, maintained the contrary with so much heat and violence, that the dispute at length ended in a bet. Ruuscher charged a Spaniard, one of his friends, who was going to Mexico, to procure for him in that country authentic proofs of what he had asserted. These proofs, legally confirmed in October 1725, by the court of justice in the city of Antiguera, in the valley of Oaxaca, arrived at Amsterdam in the autumn of the year 1726. Ruuscher caused this evidence to be published under the following title: *The History of Cochineal proved by authentic documents*.³

The fact that cochineal is an insect had been suspected before. In a very crude and unsatisfactory paper on cochineal, published in the *Philosophical Transactions* for 1668,⁴ this is distinctly stated as an undoubted fact. In 1672 Dr Lister, in a paper inserted also in the *Transactions*, throws out a conjecture that the cochineal insect may be a sort of kermes; which conjecture is now known to be well founded. Leeuwenhoek is said to have examined cochineal microscopically in 1703, and to have ascertained it to be an insect. About the beginning of the year 1757 Mr Ellis obtained some of the joints of the plant on which the

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¹ See Kuhlmann, *Ann. de Chim. et de Phys.* xxiv. 225; Zenneck Poggendorf's *Annalen*. xiii. 261; Robiquet et Colin. *Jour. de Pharmacie*, xii. 407; and *Ann. de Chim. et de Phys.* xxxiv. 225.

² For an account of it we refer the reader to the *Jour. de Pharmacie*, xiv. 354.

³ *Natuerlyke Historie van de Couchenille, beweezen mit authentique documenten*. Amsterdam, 1729, 8vo, 175 pages.

⁴ No. xl. p. 796.

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insects breed, from South Carolina, and presented them the same year to the Royal Society. These specimens, Mr Ellis observes, were full of the nests of this insect, in which it appeared in its various states, in the most minute, when it walks about, to the state when it becomes fixed, and wrapt up in a fine web which it spins about itself. With the assistance of the microscope, Mr Ellis discovered the true male insect in the parcels which had been sent to him from America; and in August 1756, in consequence of Mr Ellis's discovery, Dr Garden caught a male cochineal fly, which, he observes, is rarely to be met with. He supposes that there may be 150 or 200 females for one male. These discoveries proved indisputably that the cochineal is an animal production.

Contains
cochineal-
lin.

Cochineal has been subjected to a chemical examination by various individuals; but the most successful analysis of it is by Pelletier and Caventou in 1818, which was published in the eighth volume of the *Annales de Chimie et de Physique*, p. 250. They found it to contain about half its weight of the peculiar colouring matter to which they applied the name *carmine*; but we prefer the name cochinealin, already given to this substance by John, who was the person that first obtained it and described its properties. Cochinealin may be obtained by the following process:—

Digest cochineal in alcohol, as long as it communicates a red colour to that liquid. The alcoholic solution being left to spontaneous evaporation, lets fall a crystalline matter of a fine red colour. Dissolve these crystals in strong alcohol, and mix the solution with its own bulk of sulphuric ether. The liquid becomes muddy, and gradually deposits the cochinealin, which constitutes a purple crust on the bottom of the vessel.

Properties
of cochi-
nealin.

Cochinealin has a fine purple-red colour, is granular, and consists of small crystals. When left exposed to the air, it undergoes no sensible alteration. At 122 degrees it melts; and if the heat be increased, it swells up and is decomposed, yielding carburetted hydrogen gas, a great deal of oil, and a little water having a slightly acid taste. It furnishes no traces of ammonia.

It is very soluble in water. The aqueous solution has a fine carmine colour, and, how much soever concentrated, does not deposit crystals. It dissolves also in alcohol; but the solubility diminishes in proportion to the strength of the alcohol. In sulphuric ether it does not dissolve. The weak acids dissolve it, probably in consequence of the water which they contain. When the cochinealin is pure, no acid throws it down from its aqueous solution; but they precipitate it when in combination with the peculiar animal matter of cochineal. They produce a sensible change upon its colour, causing it gradually to assume a tint of yellow. This is the reason why cochineal will not dye scarlet, unless when mixed with bitartrate of potash. The concentrated acids decompose it altogether.

Alkalies also alter the colour of solutions of cochinealin. It first becomes violet, and at last yellow; and the original colour cannot be again restored. Lime-water occasions a precipitate when poured into an aqueous solution of this substance; but barytes and strontian water occasion no precipitate, though they change the colour to yellow. Alumina has a strong affinity for cochinealin. When newly precipitated alumina is agitated in an aqueous solution of it, the liquid is rendered colourless, and the alumina converted into a beautiful lake. The pigment called *carmine*, accidentally discovered by a Franciscan monk about the middle of the sixteenth century, and the process for obtaining which was published by Homberg in

1656, consists essentially of a combination of cochinealin and alumina.

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Most of the saline solutions alter the colour of the aqueous solution of this substance; but few of them are capable of producing a precipitate in it. Acetate of lead, however, throws down a copious violet sediment from the decoction or infusion of cochineal; and by decomposing this sediment by means of sulphuretted hydrogen, the cochinealin may be obtained in a state of purity. The chloride of tin throws down a violet precipitate, and the perchloride strikes a fine scarlet colour, but precipitates nothing. When gelatinous alumina is added to this mixture, we obtain a fine red precipitate, which is not altered by boiling.

Cochineal was at one time used in great quantity in Europe, chiefly for dyeing fine scarlet cloth. When Bancroft published his work on colours in 1794, he informs us that the annual European consumption was about 3000 bags, or 600,000 lbs., of which about 240,000 lbs. were consumed in Great Britain. The demand has since that time very much diminished; and the price has in consequence sunk from about thirty shillings to about nine shillings and sixpence per pound. This diminution is chiefly owing to the substitution of the lac dye for cochineal. Cochineal, however, is still used for the dyeing of fine scarlet cloth.

3. *Kermes*.—This is also the female of an insect which inhabits a species of oak. The tree, which is a native of the countries bordering on the Mediterranean and Asia, is called by Linnæus *quercus ilicis*, and the insect *coccus ilicis*. This substance was known to the ancients, though they were ignorant of its nature. Dioscorides calls it

Similar to
cochineal.

κοκκος, and Pliny *coccum* and *granum*. It was used in medicine; and there can be no doubt that it was employed in Asia at a very early period as a dyestuff. There is reason to suspect that the scarlet cloth mentioned by Moses to adorn the tabernacle was dyed by means of kermes. If this conjecture has any foundation, the kermes dye must have been known in Egypt before the time of Moses.

The word *kermes* or *alkermes* is at present in the East the common name for the animal which produces the dye, as well as for the dye itself. Probably it comes from the Arabic. If the kermes dye was known in Egypt and Phœnicia in the time of Moses, there is some difficulty in explaining how it was altogether unknown to the Greeks and Romans till the time of the Emperor Aurelian, who began his short reign in the year 270 of the Christian era. Vopiscus informs us that the king of Persia sent to that emperor, besides other articles of great value, some woollen cloth, which was of a much costlier and brighter purple than any that had been ever seen in the Roman empire, and in comparison of which all the other purple worn by the emperor and the ladies of the court appeared dull and faded. Vopiscus goes on to say that this cloth had been dyed in India, and that the assertion of the king of Persia, *sume purpuram qualis apud nos est*, was false; for Aurelian, Probus, and Diocletian, had sent dyers into the East on purpose to get information respecting this precious dye; but that their attempts utterly failed of success.¹

From this passage it would appear that the use of kermes in dyeing had been known at a very early period in India, from which it gradually made its way into Persia, and afterwards into Europe. And as the colour which it yielded was more beautiful than the celebrated Phœnician dye, it may have contributed to put an end to the monopoly of the Phœnician dyers. The term *scarlet*, the

¹ Vopiscus in *Vita Aureliani*, cap. 29.

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origin of which is unknown, but which was certainly employed early in the twelfth century, was applied to the colour given to cloth by the kermes dye.

Kermes is gathered chiefly in Languedoc, Spain, and Portugal. The insects are collected in the months of May and June, when the female, which alone is useful, is distended with eggs. To destroy the young insects, the kermes is exposed to the steam of vinegar for about half an hour, and afterwards dried. It is in the form of small grains of a reddish-brown colour. Kermes, as appears from the experiments of Lassaigue,¹ contains the very same colouring matter as cochineal; but its quantity is not so great, and of course it is mixed with a greater proportion of animal matter. The introduction of cochineal greatly diminished the consumption of kermes. It is seldom used in this country, yet it gives a very fixed and beautiful colour to woollen cloth.

Also similar to cochineal.

4. *Lac*.—This is an animal production which has been long known in India, and used for dyeing silk and other purposes. It is the *nidus* of the *coccus lacca*, Linnæus, and is generally produced on the small branches of the *croton lacciferum*. Three kinds of lac are well known in commerce:—1. Stick lac is the substance or comb, in its natural state, forming a crust on the small branches or twigs. 2. Seed lac is said to be only the above separated from the twigs and reduced into small fragments. Mr Hatchett, who has examined this substance with his usual skill and precision, found the best specimens considerably deprived of their colouring matter.² According to the information which he received from Mr Wilkins, the silk dyers in Bengal produce the seed lac by pounding crude lac into small fragments, and extracting part of the colouring matter by boiling. 3. Shell lac is prepared from the cells, liquefied, strained, and formed into thin transparent laminæ. There is also a fourth kind, called *lump lac*, which is obtained from the seed lac by liquefaction, and afterwards formed into cakes. The best lac is of a deep red colour: when it is pale and pierced at the top, the value is greatly diminished; for then the insects have left their cells, and it can no longer be of use as a dyestuff.

Unverdorben has likewise examined lac, but his experiments throw no light upon the nature of the colouring matter. Being derived from a coccus, as well as the colouring matter of cochineal and kermes, the probability is that it is of the same nature. In the state in which it comes to this country (that of a purple powder), it dissolves readily in boiling hot water. In this way it is employed by the dyers. Being much cheaper than either cochineal or kermes, it has in some measure superseded these dyestuffs, except when a very fine scarlet is wanted, in which case cochineal is still employed.

How prepared.

5. *Archil*.—This substance, called *orseille* by the French, is a violet-red paste, of which there are two varieties, one, which is the best, made in the Canary Islands, the other manufactured in the south of France. It is made from two species of lichens, the *roccella* and the *parellus*. Berthollet, who has copied Hellot, who again copied Micheli, has given the following description of the mode of preparing it. The plant is reduced to a fine powder, which is afterwards passed through a sieve, and slightly moistened with stale urine. The mixture is daily stirred, each time adding a certain proportion of soda in powder, till it acquire a clove colour. It is then put into a wooden cask, and urine, lime-water, or a solution of sulphate of lime (*gypsum*), is added in sufficient quantity to cover the mixture. In this state it is kept; but to preserve it any length

of time, it is necessary to moisten it occasionally with urine. We suspect that soda is not employed in the preparation of this dyestuff; at least it is not employed in the manufacture of cudbear, the preparation of which, being a manufacture of this country, we have often witnessed.

If we adopt the opinion of Tournefort, the preparation of archil was known to the ancient Greeks. He thinks that the purple of Amorgos, one of the Cyclades, the colour given to the famous tunics of that country, was formed by a dyestuff made from the lichen *roccella*.³

What is called in this country *cudbear*, and in Germany *Cudbear persio*, is prepared from the lichen *tartareus*, and *omphalodes*, by a process quite similar to that employed for making archil. The lichen is steeped and left for some time in flat vessels moistened with ammonia distilled from putrid urine. When the purple colour is sufficiently developed, the whole is dried in the open air, and reduced to a fine powder. The manufacture of this dyestuff was begun about the year 1777, at Leith, by Mr Mackintosh and Dr Cuthbert Gordon, from which last the British name of *cudbear* (originally *Cuthbert*) is derived. Leith was found an improper place for the manufacture; but Mr Mackintosh transferred it to Glasgow, and manufactured cudbear during the rest of his life with success. He left it to his son Charles Mackintosh, Esq. who still carries it on. The lichens used were at first collected in the Highlands of Scotland; but the rocks of that country being stript of their covering, the manufacturers had recourse to Sweden and Norway, and likewise to Sardinia, from which countries prodigious quantities of the lichens were brought. There is said also to be a manufactory of cudbear in Liverpool.

Neither archil nor cudbear are capable of giving fast colours to cloth; but they are considered as indispensable by the dyers, because they greatly improve the brilliancy of some of the colours.

The nature of the substance in the lichen *roccella*, which furnishes the colouring matter of archil, has been investigated by Heeren, who has distinguished it by the name of *erythrin*. It may be obtained from the lichen by the following process: Digest the lichen for some time in alcohol, taking care not to raise the heat to the boiling point, because at that temperature a portion of the erythrin is decomposed. The alcoholic solution has a green colour. Filter it while hot, and mix it with twice its bulk of water, which will render it muddy. Raise the liquid to the boiling temperature, and introduce into it chalk in powder, until the precipitate, which was at first dispersed through the liquor, collects in flocks. This precipitate consists chiefly of *roccellate of lime*.⁴ The liquid must be filtered while boiling hot. During the cooling it deposits erythrin in the state of a fine powder, of a brown colour. Dissolve it in hot alcohol, digest the solution with ivory black, filter, and mix it with one and a half times its bulk of boiling water. The liquor remains at first clear, but during the cooling the erythrin precipitates nearly white.

The following process for extracting erythrin from the lichen *roccella* is easier than the preceding. Pour on the lichen a small quantity of concentrated ammonia, and digest for some time, stirring well, but without the application of heat. Dilute the muddy and reddish solution thus obtained with water; and then add to it some dilute solution of chloride of calcium. Roccellate of lime precipitates, and the filtered liquid has a reddish colour. Add to it a slight excess of muriatic acid. The erythrin precipitates instantly, and gives the liquid the aspect of a yellowish jelly. When we

¹ *Ann. de Chim. et de Phys.* xii. 102.

² *Phil. Trans.* 1804.

³ Tournefort's *Voyage*, i. 248, English translation.

⁴ Roccellic acid is an acid discovered by Heeren in the lichen *roccella*.

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Colours.Its proper-
ties.

heat to the boiling temperature, the erythrin is again dissolved, and it is precipitated in powder during the cooling of the liquid. It may be deprived of its brown colour by ivory black.

Erythrin is a soft powder, having usually a slight shade of red, and a slightly crystalline aspect, when obtained from a weakly acid liquid. When pure it is perfectly white. It has neither taste nor smell. At a temperature a little above 212° , it melts into a transparent liquid, which becomes hard and brittle during the cooling. If the heat be raised still higher, it froths, is partly volatilized, and partly charred; but not the least trace of ammonia can be observed to be formed. Hence we may conclude that erythrin contains no azote. When held to the flame of a candle it burns like a resin. It is scarcely soluble in cold water, and requires 170 times its weight of boiling water to dissolve it. At the temperature of 53° it dissolves in twenty-two and a half times its weight of alcohol, of specific gravity 0.825. It is soluble in 2.29 times its weight of the same alcohol at the point of ebullition. When this last solution cools, the whole is converted into a mass of the consistence of mortar. It is insoluble in ether, and little soluble in oil of turpentine. Muriatic acid has no action on it, but acetic acid dissolves it with facility when boiling hot, but lets it fall again on cooling. Both nitric acid and concentrated sulphuric acid dissolve it, but they alter its nature. The aqueous solutions of the alkalies, or their carbonates, dissolve it with facility, and the solutions are colourless. By the continued action of the alkalies, the erythrin is decomposed. When this action takes place in close vessels, an extractive substance is formed, which is soluble in water, having a bitter taste, and which Heeren on that account has called *bitter of erythrin*. When the action is continued in vessels to which the air has access, the red or rather violet substance is formed which constitutes the colouring matter of archil.

During the conversion of erythrin into the red matter three different substances are obtained, namely, the *red colouring matter*, a *yellow substance*, and a *wine-red substance*. They are first mixed or combined; but the red colouring matter may be separated by dissolving the compound substance in alcohol, evaporating the solution to dryness, and digesting the residue in ammonia. The red colouring matter remains when this solution is evaporated.

It is little soluble in water. Alcohol dissolves it, and the solution has a crimson-red colour. It is quite insoluble in ether. The alkalies and their carbonates dissolve it, and the solution has a fine deep colour. The acids throw it down from these solutions under the form of carmine red powder, but they do not precipitate it from its solution in alcohol. Heeren has shown that alcohol has the property of altering erythrin, and of converting it into a snow-white substance, to which he has given the name of *pseudo-erythrin*, because it does not yield the red colouring matter, but only the wine red. It has been analyzed by Liebig, who found its constituents,

Carbon.....	60.810
Hydrogen.....	6.334
Oxygen.....	32.856
These correspond with	
8 atoms carbon.....	6
5 atoms hydrogen.....	0.675
$3\frac{1}{4}$ atoms oxygen.....	3.25
	—
	9.925

Hence these atoms, or some multiple of them, must represent the composition of pseudo-erythrin.

Colouring
matter of
cudbear.

The colouring matter of cudbear is obviously very nearly the same as that of archil. It has been slightly exa-

mined also by Heeren, who has pointed out some distinctive characters which it possesses.

In France, besides the lichen parellus, the lichen dealbatus is employed, and the archil is obtained by treating the lichens with putrid urine and lime. Robiquet has subjected the lichen dealbatus to a chemical analysis, and has extracted from it the matter which yields the red dye, and which he has distinguished by the name of *orcin*. It constitutes white crystals, having a sweetish and nauseous taste, melts when heated, and may be distilled over without decomposition. It dissolves both in water and alcohol. It is obvious that its properties are quite different from those of erythrin; yet the process for converting it into the red dyestuff is nearly the same as for archil and cudbear.

6. *Carthamus*, or *Safflower*.—This is the petals of the blossoms of the carthamus tinctorius, a plant formerly cultivated in Germany and France; but now the dyestuff comes usually from Egypt and the countries round the eastern part of the Mediterranean, and from India.

The method of preparing the flowers of carthamus in Egypt, as it is described by Hasselquist, is the following. After being pressed between two stones, to squeeze out the juice, they are washed several times with salt water, pressed between the hands, and spread out on mats in the open air to dry. In the day time they are covered, that they may not dry too fast with the heat of the sun, but they are left exposed to the dew of the night. When they are sufficiently dry, they are put up, and kept for sale under the name of *saffranon*. Care should be taken afterwards not to keep it in too dry a place; for unless it is a little moist, its properties are considerably impaired.

Carthamus contains two colouring substances, a yellow substance, which is soluble in water; and as it is of no use, it is extracted by the process mentioned above, by squeezing the flowers between stones till no more colour can be pressed out. The flowers become reddish in this operation, and lose nearly one half of their weight. The other colouring matter, which is red, is soluble in alkaline carbonates, and it is precipitated by means of an acid. A vegetable acid, as lemon juice, has been found to produce the finest colour. Next to this, sulphuric acid produces the best effect, provided too great a quantity, which would alter and destroy the colour, be not employed. The juice of the berries of the mountain-ash, or rowan-tree (*sorbus aucuparia*, Lin.), is recommended by Scheffer as a substitute for lemon juice, and it is thus prepared. The berries are bruised in a mortar with a wooden pestle, and the expressed juice, after it has been allowed to ferment, is bottled up. The clear part, which is most acid, becomes fitter for use the longer it is kept; but this operation requires a period of some months, and can only be conducted in summer.

From the colouring matter extracted by means of an alkali, and precipitated with an acid, is procured the substance called *rouge*, which is employed as a paint for the skin. The solution of carthamus is prepared with crystals of soda, and precipitated with lemon juice which has stood some days to settle. After being dried on delft plates with a gentle heat, the precipitate is separated, and ground accurately with talc which has been previously reduced to a very subtile powder; and on the fineness of the talc depends the difference between the cheaper and dearer kinds of *rouge*.

Carthamus furnishes about five per cent. of this matter (abstracting the talc), which is the true red colouring matter. It reddens vegetable blues while moist, whether from the acid employed in throwing it down, or from its own acid properties, has not been determined. It is insoluble in water and dilute acids, but slightly soluble in

Simple
Colours.Its colour-
ing matters

Rouge.

Simple
Colours.

alcohol. The solution has a rose-red colour, but when boiled becomes yellow. Ether is still a worse solvent of *rouge* than alcohol. It is insoluble in oils, both volatile and fixed; but it dissolves readily, and with a yellow colour, in alkaline leys, or alkaline carbonates. According to Dobereiner (who considers it as an acid, which he calls *carthamic*), soda saturated with it crystallizes in fine colourless needles, having a silky lustre, which become instantly red when an acid is added to them.

As a dyestuff, safflower affords only a fugitive colour, destroyed by exposure to the sun, and removed by washing. It is used, however, occasionally to give a red colour to silk.

7. *Brazil Wood*.—This wood comes from Brazil, and from Pernambuco; and in the former case is said to be the wood of the *cæsalpina sapan*, *cæsalpina crista*, and *cæsalpina vesica*; in the latter, of the *cæsalpina echinata*. These trees are large, and rich in colouring matter. The wood is very hard, and is said to sink in water. When fresh cut it is pale, but becomes reddish by exposure to the air. Its taste is sweetish. The red colouring matter of Brazil wood is very easily acted on by chemical agents, acids rendering it *yellow*, and alkalies *violet*. Chevreul has given us the following process for extracting this colouring matter in a state of purity. Digest the raspings of the wood in water till that liquid has dissolved all the colouring matter, and evaporate the infusion to dryness, to get rid of a little acetic acid which it contains. Dissolve the residue in water, and agitate the solution with litharge, to get rid of a little fixed acid which it contains. Evaporate again to dryness. Digest the residue in alcohol: filter and evaporate to drive off the alcohol. Dilute the residuum with water, and add to the liquid solution of gelatine, till all the tannin which it contains is precipitated. Filter again, evaporate to dryness, and digest the dry mass in alcohol, which will leave undissolved the excess of gelatine that may have been added. This last alcoholic solution being evaporated, the pure colouring matter of Brazil wood remains behind.

Colouring
matter
how ob-
tained.Its proper-
ties.

It is soluble in water and in alcohol, but its fine red colour does not appear till all the acid which it naturally contains is saturated. Acids give it a yellow colour. The sulphuric, nitric, and muriatic acids, give it a pale dirty yellow. Fluoric acid gives it at first a yellow colour, which is gradually altered to grayish green; while the phosphoric and citric give it a fine permanent yellow colour, which might be employed for dyeing silk and wool. For these facts we are indebted to Bonsdorf. A very minute quantity of alkali gives the infusion of Brazil wood a violet colour; it is therefore a delicate re-agent for alkalies. When neutral salts, with an alkaline base, are dissolved in the infusion of Brazil wood, it assumes a rose-red colour. Acetates act most decidedly in producing this effect. When newly precipitated alumina is agitated in this infusion, it assumes a carmine-red colour.

When Brazil wood is boiled in water, we obtain a rose-coloured solution, and the undissolved wood becomes black, but still yields to alcohol a dark-red colour. When an acid is poured into the decoction, a red precipitate falls, and the filtered liquid is yellow. Ammonia gives the decoction a purple colour, and throws down a purple precipitate. The carbonates of potash and soda render it carmine red, and throw down a precipitate of the same colour. Alum throws down an abundant carmine precipitate, but the liquid retains the same colour. The protochloride of tin gives a rose-red precipitate, and renders the decoction colourless.

Forms red
ink.

Brazil wood is the substance from which red ink is prepared. The colour which it communicates to cloth has very little permanence; yet it is occasionally employed

in dyeing cotton what are technically called *chemical colours*, by which is understood colours that will not resist washing. The decoction of Brazil wood, which is called juice of Brazil, is found to answer better for the process of dyeing when it has been kept some time, and has even undergone some degree of fermentation, than when it has been fresh prepared. The colour by keeping becomes of a yellowish red.

Simple
Colours.

Within the last five or six years, Brazil wood has been nearly superseded by a wood imported from Africa, to which our dyers give the name of *camwood*. It is richer, and gives a finer colour, than any of the varieties of Brazil wood. It is not so much affected by alkalies, nor so liable to assume a violet shade; and the yellow colouring matter with which it is mixed gives the red a more lively appearance. We have not learned the botanical name of the tree which yields this wood.

8. *Logwood*.—This wood is usually, on the Continent, called *Campeachy wood*. It is the wood of the *hematoxylon Campeachianum*, a tree which grows to a considerable size in Jamaica, and on the eastern shore of the Bay of Campeachy. Its specific gravity is greater than that of water; it has a fine grain, and is susceptible of a fine polish. Besides the colouring matter to which it owes its value, logwood contains resin and oil, which are soluble in water; acetic acid and salts, consisting of potash and lime, combined with a vegetable acid, which are soluble in water saturated with chloride of potassium. It contains also sulphate of lime, oxalate of lime, a little alumina, and some peroxide of iron and oxide of manganese. Chevreul, to whom we are indebted for a chemical examination of logwood, has given the following process for extracting its colouring matter, which he has distinguished by the name of *hematin*.

Yields he-
matin.

The raspings of the wood are digested in water of a temperature from 122° to 131°, till every thing soluble is taken up. Evaporate the aqueous solution to dryness by a gentle heat, and treat the residue with alcohol of the specific gravity 0.843, which dissolves the colouring matter, leaving a brown residue still containing colouring matter in chemical combination. Filter the alcoholic solution, and distil it till what remains becomes of the consistence of a syrup. This syrup being mixed with some water, crystals begin immediately to be deposited. Leave it for twenty-four hours to evaporate spontaneously, then decant the liquid portion from off the crystals, and wash them with a little alcohol. The decanted liquid being left to spontaneous evaporation, will yield more crystals, and finally remains a thick uncrystallizable liquid. If it be evaporated to dryness, macerate the dry mass in cold water, and evaporate afresh: more crystals are obtained, which may be purified, like the other, by washing them in alcohol. These crystals thus obtained constitute *hematin*, or the pure colouring matter of logwood.

They have considerable lustre, and a scarlet colour. Under the microscope they appear to constitute needles arranged in sphericles. When rubbed on a glass it appears *orange* by transmitted light, and white by reflected light. But if we let fall on it a drop of alcohol, it appears *carmine red* by transmitted, and *yellow* by reflected light. When put into the mouth it is at first tasteless; but after some time a sensation of astringency, acridity, and bitterness, is perceived. When heated in a retort to decomposition, it gives out among other products ammonia, from which we may conclude that it contains azote. After every thing volatile is driven off, there remains fifty-four per cent. of charry matter half fused; which, when burned in the open air, leaves a quantity of lime and peroxide of iron, amounting to rather less than one per cent. of the hematin employed.

Its proper-
ties.

Simple
Colours.

Hematin requires for solution 1000 times its weight of water. By evaporation it does not yield crystals, but when very much concentrated it is converted into a confused crystalline mass. It dissolves in alcohol and ether, and the solutions have a reddish-yellow colour. It combines with the acids, which render it yellow when added in small quantity; but when in a larger proportion they give it a red colour. Sulphurous acid and carbonic acid give the solution of hematin a pale-yellow colour. Boracic acid gives it a pale-red, and phosphoric and phosphorous acid a pale-orange colour. Arsenious acid has no sensible action on it. Sulphuretted hydrogen gas renders it yellow; and if we keep a solution of hematin charged with this gas for some time in a corked phial, it loses its colour altogether; but the colour appears if we remove the gas by means of a little oxide of lead. The salifiable bases give solution of hematin a violet, purple, or blue colour. With the fixed alkalies it forms compounds perfectly saturated and soluble. The alkaline earths fall down in combination, and have a purple colour when they fall from neutral salts, and a blue colour when from subsalts. An excess of alkali destroys the colour altogether. With the hydrated oxides of antimony, zinc, bismuth, nickel, iron, and copper, it forms blue or purple coloured compounds. The compound which hematin forms with alumina and oxide of copper at once may be fixed upon linen or cotton, and gives a blue colour like that of indigo, only it is rendered yellow by the concentrated acids, while indigo remains unchanged, unless the acid be the nitric. The protoxide of tin, when united with hematin, forms a blue-coloured compound, while its combination with the peroxide of tin is red. We see from this that the protoxide of tin possesses the characters of an alkali, while the peroxide is an acid. A solution of gelatine throws down a concentrated solution of hematin purple.

Hematin is easily altered. When a mixture of alkali and hematin is kept *in vacuo*, or in a well-corked phial, quite full, no action takes place; but when air has access, oxygen is absorbed, and the hematin quite destroyed in a few hours. During this action, the blue colour of the liquid changes first into red, and then into brown. The alkali becomes saturated with carbonic acid.

II.—Method of dyeing Wool Red.

All the colouring matters employed for dyeing wool red by modern dyers require a mordant to fix them. The shade of colour depends partly upon the kind of colouring matter used, partly on the mordant, and partly on the quantity of colour which the cloth is made to imbibe by the length of time that it remains exposed to the action of the dyeing liquor. The purple of the ancients, the colouring matter of which was obtained from different species of shell-fish, required no mordant; but it has already been observed that this mode of dyeing has been for ages out of use.

Madder
red.

Madder Red.—Madder is only employed for dyeing coarse woollen stuffs; and the following is the process. The stuffs are first boiled for two or three hours with alum and tartar; they are then left to drain, slightly wrung out, put into a linen bag, and carried into a cool place, where they are to remain for some days. The quantities and proportions of the alum and tartar are varied according to the views of the dyer, and the shade of colour which is wanted. Some recommend five ounces of alum and one ounce of tartar to each pound of wool. By increasing the proportion of tartar to a certain degree, a deep and permanent cinnamon colour, instead of a red, is produced. This arises from the yellow tinge which is induced by means of the acid on the colouring particles of the madder. Others propose to diminish the proportion of tartar,

and to employ only a seventh part. In conducting the process of dyeing with madder, the bath should not be brought to the boiling point; because at that temperature the fawn-coloured particles would be dissolved, and a different shade obtained from that which is desired. When the water is at that degree of temperature which the hand can bear, Hellot recommends the addition of half a pound of grape madder for every pound of wool to be dyed. It is then to be well stirred before the wool is introduced, which must remain for an hour without boiling, excepting for a few minutes towards the end of the process, that the combination of the colouring particles with the stuff may be more certain.

Madder reds are sometimes rosed, as it is called, with archil and Brazil wood. In this way they become more beautiful and velvety; but this brightness is not permanent. But madder reds, even when they are most perfect, are far inferior to those obtained from lac and cochineal, and even to that produced by kermes; but as the expense of the materials is comparatively small, they are employed, as we have already observed, for coarse stuffs.

Different authors recommend different proportions of madder. Poerner proposes to employ one third of the weight of the wool, while Scheffer limits the quantity to one fourth. In one process, Poerner added to the alum and tartar a quantity of solution of tin equal in weight to the tartar, and after two hours boiling allowed the cloth to remain in the bath, which had been left to cool for three or four days. He then dyed it in the usual way, and thus obtained a fine red. According to another process, he prepared the cloth by the common boiling, and dyed it in a bath slightly heated, with a larger proportion of madder, tartar, and solution of tin. The cloth remained twenty-four hours in the bath; and when it had become cold he put it into another bath, made with madder only, where it remained for twenty-four hours. By this process he got a fine red, somewhat brighter than the common, but inclining a little to yellow. Scheffer informs us that he obtained an orange-red by boiling wool with a solution of tin and one fourth of alum, and then by dyeing with one fourth of madder. A cherry colour is obtained, according to Bergman, by dyeing with one part of a solution of tin and two of madder, without previously boiling the wool. By exposure to the air this colour becomes deeper. By boiling the wool for two hours with one fourth of sulphate of iron, then washing it, and afterwards immersing it in cold water with one fourth of madder, and then boiling for an hour, the result is a coffee colour. But if the wool has not been soaked, and if it be dyed with one part of sulphate of iron and two of madder, the colour is a brown approaching to red.

When sulphate of copper is employed as the mordant, the madder dye yields a clear brown, inclining somewhat to yellow; and a similar colour may be produced by dyeing the wool, simply soaked in hot water, with one part of sulphate of copper and two of madder. But when this mordant and dyestuff are used in equal proportions, the yellow is somewhat more obscure, approaching to green; and in both these instances exposure to the air does not produce a darker colour. Berthollet informs us that he employed a solution of tin in various ways, both in the preparation and the application of the madder; and by the use of different solutions of tin, he found, that although the tint was somewhat brighter than what is obtained by the common process, it was always more inclined to yellow or fawn colour.

Scarlet.—The finest and most splendid of all colours is scarlet. This, like other colours, is of various shades, according to the quality and proportion of the colouring matter employed. The scarlet dye is communicated to wool-

Simple
Colours.
Process.

Rosing.

Proportion
of madder.Different
mordants.

Scarlet.

Simple Colours.

Simple Colours. Brighter red.

len stuffs by means of cochineal, the history and properties of which we have already detailed. The Mexicans, as appears from their history, employed alumina as the basis or mordant to fix the colour of cochineal; and previous to the discovery of the solution of tin, the use of the same substance seems to have prevailed in Europe. The fine colour obtained from the latter received, as we have already mentioned, different names in different places; as that of *bow dye* in England, *scarlet of the Gobelins* in France, and in Holland *Dutch scarlet*.

Process.

Boiling.

In the process for dyeing scarlet two operations are necessary. The first is denominated the boiling, and the second is distinguished by the name of finishing or reddening. The operation of boiling, which is the first part of the process, is conducted in the following manner:—For one hundred pounds of cloth, six pounds of pure tartar are added to the water, which is made pretty warm. The bath is then to be briskly stirred; and when the heat has increased a little more, half a pound of powdered cochineal is to be added, and the whole is then to be well mixed. The next moment five pounds of a very clear solution of tin are to be poured in and carefully mixed. When the bath begins to boil, the cloth is introduced, and briskly moved for two or three turns: after which it is moved more slowly. The boiling having continued for two hours, the cloth is taken out, exposed to the air, and carried to the river to be well washed.

Reddening.

In the preparation of the second bath, which is for the reddening, the boiler is to be emptied, and when the bath has just reached the boiling point, five pounds and three quarters of cochineal, previously powdered and sifted, are to be added. These are to be carefully mixed; and after having ceased stirring, when a crust has formed on the surface, and opened of itself in several places, thirteen or fourteen pounds of solution of tin are poured in. Should the bath during the boiling rise above the edge of the boiler, it may be cooled with a little cold water. This solution being well mixed, the cloth is put in, and two or three times quickly turned. It is then boiled in the bath for an hour, taking care to keep it under the surface. It is afterwards taken out, exposed to the air, and, when it has cooled, washed in the river and dried.

Proportion of ingredients.

There are no determinate proportions of cochineal and solution of tin in either of these operations. Hellot informs us that some dyers employ two thirds of solution of tin and one fourth of cochineal in the boiling or first operation, and the other one third of the solution of tin with the remaining three fourths of the cochineal in the second operation, or the reddening. He adds farther, that the use of tartar gives a greater degree of permanency to the colour, provided the proportion do not exceed one half the weight of the cochineal employed. According to Berthollet, several dyers at present adopt this practice. Tartar, he observes, promotes the solution of the colouring matter; and this effect is greater when it is ground with the cochineal, after which it is found that the residuum is more completely exhausted. But this consideration is of inferior consequence when the operations are successively performed, because any colouring matter that may remain in the residuum is employed in the next operation. It ought not, however, to be overlooked, that the tartar communicates to the colour a rosy hue.

Shorter process.

It is the practice of some dyers not to remove the cloth out of the boiling. They merely refresh it, and perform the operation of reddening in the same bath. When this is done, the infusion of cochineal, made in a separate vessel, and mixed with the proper proportion of solution of tin, is added. By conducting the process in this way the scarlet is supposed to be equally fine, and there is a considerable saving of time and fuel.

To give scarlet the bright lively red, which, as it approaches to the colour of fire, has been distinguished by the name of *fiery scarlet*, a yellow tinge is communicated by boiling fustic in the first bath, or by adding a little turmeric to the cochineal. A larger proportion of the solution of tin also produces this yellow shade, but it renders the cloth harsh, and limits the action of the colouring matter. The use of fustic or turmeric, therefore, although the colour obtained from them is not permanent, is preferable to an excess of the solution of tin. When these substances are used, the inside of the cloth, when it is cut, appears yellow; but in the ordinary processes, the cochineal, it is found, does not penetrate the cloth, for when no other substance is employed the cloth is internally white.

The use of tin boilers is recommended in dyeing scarlet. When copper boilers are employed, the acid acts on the metal, and thus forming a solution, injures the beauty of the colour. Tin boilers, however, are attended with several inconveniences. It is difficult to procure them of sufficient size, and they are apt to be melted by the incautious continuance of the fire after they have been emptied. In the use of copper boilers there are several necessary precautions. They must be kept very clean, the acid liquor should not be allowed to remain in them for any length of time, and some contrivance should be adopted to prevent the cloth from touching the metal, either by using a net or a wicker basket.

Different proportions of materials, we have observed, are recommended by different authors. For the boiling, Scheffer directs an ounce and a half of solution of tin, with an equal quantity of starch, and as much tartar, to every pound of cloth. The effect of the starch is to give more uniformity to the colour. When the water boils, a dram of cochineal is to be added; it is then to be well stirred, and after the wool is introduced, to be boiled for an hour, taken out, and washed. The proportions for the reddening bath, in which the wool is to be boiled half an hour, are half an ounce of starch, three fourths of an ounce of solution of tin, half an ounce of tartar, and seven drachms of cochineal. In Scheffer's process, it may be observed, the proportion of solution of tin is smaller than in that of Hellot, but the quantity of tin in the solution of the former is greater than in that of the latter.

Poerner has described three principal processes, according to the variety of the shade of the scarlet. He uses no cochineal in the boiling; the materials of which are one ounce and six drachms of tartar, and an equal weight of solution of tin, the latter being added after the tartar is dissolved, for every pound of cloth. As soon as the boiling has commenced, the cloth is introduced, and it is boiled for two hours. For the reddening of the first process he employs two drachms of tartar and one ounce of cochineal, adding gradually afterwards two ounces of solution of tin. For the reddening of the second process the same quantity of cochineal and solution of tin, without any tartar, is employed. In the reddening of the third process, two drachms of tartar with one ounce of solution of tin, one ounce of cochineal, and two ounces of common salt, are directed to be used. The colour produced in the first process has the deepest shade, that of the second is more lively, while that of the third is paler and brighter.

By the use of tartar in the reddening in different proportions, various shades of scarlet may be obtained. When it is employed, the shade is deeper and fuller; but when it is entirely omitted, the scarlet approaches to an orange colour. The shade of colour also is subject to considerable variety, from the different degrees of strength of the solution of tin. To ascertain this effect, Berthollet made a number of experiments. He found that a solution of tin, composed of sixteen parts of nitric acid, two of muriate of

Simple
Colours.

ammonia, and three of tin, produced a deeper shade than when the proportions of the acid and muriate of ammonia were equal, with only two parts of tin. The last proportions, he observes, succeeded best. Four parts of water were mixed with the solution. When the proportion of muriate of ammonia amounted only to half a part, the colour was brighter, and inclining to orange.

Use of
common
salt.

Common salt has the effect of increasing the brightness of scarlet, while it is also attended with the advantage of causing the colour to penetrate deeper into the cloth. It seems difficult to explain why common salt, which gives a deeper shade to the colour of the infusion of cochineal, and indeed produces a similar effect on colours in general, should diminish the intensity of the colour of scarlet. The proportion of common salt mentioned above is, according to Poerner, the greatest that can be employed. When less is used, the shade, though lighter, is more agreeable. By adding five ounces of white sugar to the ingredients of the second process, a fine colour, which is always lighter than that of the first process, will be obtained. The colour, it is said, is more permanent, and the shade more agreeable, when the cloth is left twenty-four hours in the boiler after it has cooled.

Method of
using the
lac dye.

For dyeing fine woollen cloth the lac dye is commonly used. It comes to the dyer in the state of a fine powder, having a brownish-red colour, inclining to violet. It contains much less colouring matter than cochineal, but is incomparably cheaper. To dye forty-three pounds of fine woollen cloth, six pounds of lac, three pounds of cream of tartar, and five pounds of tin mordant are put into a dyeing vessel, either of tin, or at least lined with tin, with a sufficient quantity of water. The whole is brought to the boiling temperature, and after it has boiled briskly a sufficient time to dissolve the colouring matter, the cloth is passed through it for about an hour, or till it has acquired the requisite depth of colour.

Tin mor-
dant, how
made.

The tin mordant used is made by dissolving two ounces of tin in thirty pounds of aquafortis mixed with one pound of muriatic acid. The solution is transparent, and it is kept in well-corked bottles for use. The tin is doubtless in the state of protochloride, though it sometimes also gets into the state of perchloride. Either state will answer, but in the second case the dyeing process is much slower, the cloth not seeming to imbibe the perchloride of tin so rapidly as the protochloride. From the above proportions, it is obvious that to dye forty-three pounds of woollen cloth scarlet, one third of an ounce of tin converted into protochloride is sufficient. This is rather less than 146 grains of tin; so that each pound of the woollen cloth combines with not more than 3.4 grains of tin. It is obvious from this that the particles of tin must be exceedingly minute indeed, otherwise 3.4 grains of tin could not be so minutely divided as to cover the surface of a pound weight of woollen cloth.

When the dyer wishes the scarlet to assume a brighter shade, he sometimes adds a little quercitron bark, which, by the yellow colour which it induces, adds materially to the brightness of the colour. This plan was first suggested by Dr Bancroft, and it has been since pretty generally acted on.

Dr Bancroft recommended the tin mordant to be prepared by dissolving tin in muriatic acid mixed with one fourth of its weight of sulphuric acid. This solution, he says, answers very well, and is much cheaper. We cannot find, however, that any of the dyers in this country follow that process. We can hardly think that the present method of using so much nitric and so little muriatic acid is

a good one. The object being to obtain a protochloride of tin, one would think that muriatic acid would be a better vehicle. Tin dissolves in this acid very well, and the protochloride of tin formed in this way is easily obtained in crystals. But the tin mordant, as prepared by the dyers, contains a great excess of nitric acid; and we cannot avoid suspecting that this excess is connected with the shade of scarlet produced. The nitric acid doubtless renders a part of the colouring matter of the lac yellow, and thus changes the dark crimson colour natural to this dyestuff into scarlet.

Cochineal is still employed to a considerable extent in dyeing the finest kinds of woollen cloth scarlet. The process is precisely the same as when lac is employed, remembering only that cochineal is much richer in colouring matter than lac, and that therefore a smaller quantity will serve. Dr Bancroft introduced the method of putting the cochineal, the tin mordant, and the tartar into the dyeing vessel at once, and dissolving them all together in water before the cloth is passed through the liquid; and this method is pretty generally though not universally followed.

Dr Bancroft's method of using quercitron bark to supply the place of a portion of the cochineal, is likewise pretty generally followed. The price of cochineal, in consequence of the introduction of the lac dye, has sunk from thirty shillings the pound to about nine shillings and sixpence. This makes the saving not so considerable in point of expense as it was when Bancroft wrote, though even at present it is an important saving.

To produce different shades of scarlet, and the other colours which are derived from it, all that is necessary is to vary the proportions of cochineal, tartar, and solution of tin; and for the shades which incline most to yellow, the addition of quercitron bark or fustic is requisite. The use of the tartar is to deepen the colour, and the solution of tin produces a shade of orange. When the shade of colour required to be communicated to the stuff is light, the time of continuing the process must be shortened.¹

Crimson.—The processes which are employed to dye wool a crimson colour are two. The stuff is either dyed crimson at once, or the crimson shade is communicated to it after being previously dyed of a scarlet colour. To dye crimson by a single process, a solution of two ounces and a half of alum and an ounce and a half of tartar for every pound of stuff, is employed for the boiling, and the stuff is afterwards to be dyed with an ounce of cochineal. It is usual also to employ solution of tin, but in smaller proportion than for dyeing scarlet. The processes employed, it is scarcely necessary to observe, must vary according as the shade wanted is deeper or lighter, or more or less distant from scarlet. Common salt is also employed by some in the boiling. To render the crimson deeper, and to give it more bloom, archil and potash are frequently used; but this bloom, it ought to be observed, is extremely fugacious. By adding tartar and alum, the boiling for crimson is sometimes prepared after a scarlet reddening; and it is said that the colour possesses more bloom when both the boiling and reddening are made after scarlet, than when the crimson is dyed in a fresh bath prepared on purpose. In dyeing these colours the wild cochineal may be employed; but as it contains a smaller proportion of colouring matter, the quantity must be greater.

Different substances, as the alkalies, alum, and earthy salts in general, convert the colour of scarlet to crimson, which is the natural colour of cochineal. To effect this, the stuff previously dyed scarlet is boiled for an hour in a

Simple
Colours.Different
shades of
scarlet.dyed by
one pro-
cess,or by the
conversion
of scarlet.¹ Berthollet, ii. 194.

Simple
Colours.

solution of alum, the strength of which is to be regulated by the depth of shade required. In conducting this process, it is necessary to observe, that water impregnated with earthy salts has a considerable effect in varying the shade, so that the quantity of alum employed must be proportioned to the purity of the water. Hellot tried soap, soda, potash, and some other substances, and although they produced the crimson, yet it was of a deeper shade, and had less lustre, than what was produced by means of alum. Ammonia produced a good effect, but, from its great volatility, a considerable proportion must be put into the bath, moderately heated, with a little sal ammoniac, and an equal quantity of potash. By this process the stuff became of a bright rosy colour, and thus rendered a smaller quantity of cochineal necessary. Poerner directs the stuff, previously dyed scarlet, to remain twenty-four hours in a cold solution of sal ammoniac and potash.

Half-grain
crimson,
&c.

To produce crimsons, as well as scarlets, in half grain, madder is to be substituted for half the quantity of the cochineal; or in other proportions, according to the shade desired. The same boiling is given as for scarlet in grain, and the other parts of the process are to be conducted as for reddening the scarlet or crimson. Even the common madder red assumes a greater degree of lustre when the boiling is made after the reddening for scarlet.

At present we are not aware that kermes is ever employed by the dyers in this country. The use of this dye-stuff seems to have been completely superseded by cochineal and lac dyes. Certainly the colour given by kermes is not so fine as that given by these substances, but it has the advantage of being exceedingly durable.

III.—Method of dyeing Silk Red.

Different
processes
with mad-
der.

Madder Red.—The colour which is obtained from madder does not possess sufficient brightness for dyeing silk. We shall here, however, describe some of the processes which are employed for this purpose. That of De la Folie is the following: Half a pound of alum is to be dissolved in each quart of hot water, and two ounces of potash are afterwards to be added. When the effervescence has ceased, and the liquor has become clear, the silk must be kept in it for two hours, after which it is to be washed and put into the madder-bath. The silk which is dyed in this way becomes more beautiful by means of the soap proof. The process of Scheffer is somewhat different. For each pound of scoured silk he directs a solution of four ounces of alum and six drachms of chalk to be prepared. When the sediment has formed, the solution is to be decanted, and having become quite cold, the silk is immersed in it, and left for eighteen hours. It is then taken out and dried, and afterwards dyed with an equal weight of madder. The colour thus obtained is of a dark shade. Mr Gühliche describes another process. For every pound of silk he proposes a bath of four ounces of alum and one ounce of solution of tin. When the liquor has become clear it is decanted, and the silk carefully soaked in it for twelve hours, after which it is to be immersed in a bath with half a pound of madder softened by boiling with an infusion of galls in white wine. The bath is to be kept moderately hot for an hour, and then made to boil for two minutes. The silk, being taken from the bath, is to be washed in a stream of water, and dried in the sun. The colour thus obtained is very permanent. By leaving out the galls it is clearer. The brightness of the first colour may be considerably increased by passing the stuff through a bath of Brazil wood, to which one ounce of solution of tin is added. In this way the colour becomes extremely beautiful and durable.

Process
with Bra-
zil wood.

Silk is sometimes dyed with Brazil wood, and the colour thus obtained has been distinguished by the name of

false crimson, to distinguish it from the more durable colour which is produced by cochineal. The silk, after being boiled with soap, is to be alumed. It is then to be refreshed at the river, and dipped in a bath more or less charged with Brazil juice, according to the depth of shade required. If pure water be employed, the colour will be too red for crimson; but to remedy this, the stuff may be passed through a weak alkaline solution, or a little alkali may be added to the bath, or the stuff may be washed in hard water till it has acquired the proper shade. To deepen the shade of false crimsons or dark reds, the solution of logwood is added to the Brazil bath, the silk being previously impregnated with the latter; or a little alkali may be added, according to the shade required.

Simple
Colours.

The crimson produced by cochineal is called *grain crimson*, to distinguish it from false crimson. The silk, being well cleansed from the soap at the river, is to be immersed in alum liquor of the full strength, and to remain for a night. It is then to be washed and twice beetled at the river. The bath is prepared by filling a long boiler two thirds with water, to which are added, when it boils, from half an ounce to two ounces of powdered white galls for every pound of silk. When it has boiled for a few moments, from two to three ounces of cochineal, also powdered and sifted, for every pound of silk, are put in, and afterwards one ounce of tartar to every pound of cochineal. When the tartar is dissolved, one ounce of solution of tin is added for every ounce of tartar. In the preparation of this solution of tin, the following proportions are recommended by Macquer. For every pound of nitric acid two ounces of sal ammoniac, six ounces of fine grain tin, and twelve ounces of water, are employed. When these ingredients are mixed together, the boiler is to be filled up with cold water; and the proportion of the bath for every pound of silk is about eight or ten quarts of water. In this the silk is immediately immersed and turned on the winch till it appear to be of a uniform colour. The fire is then increased, and the bath is kept boiling for two hours, taking care to turn the silk occasionally. The fire is afterwards put out, and the silk put into the bath, where it is allowed to remain for a few hours longer. It is then taken out, washed at the river, twice beetled, wrung, and dried. Two processes are recommended by Scheffer and Macquer. In that of the former, a greater proportion of cochineal is employed in the dye-bath; but in that of the latter, a yellow ground is previously communicated to the silk. The colour which is thus obtained resists the action of soap, and is more durable than that which is produced by means of carthamus.

To obtain other shades of red, the above processes must be varied. If, after the silk has been wrung out of the solution of tin, it is steeped for a night in a cold solution of alum, in the proportion of one ounce to a quart of water, wrung, and dried, then washed and boiled with cochineal, it will only appear of a pale poppy colour; but a fine poppy red may be produced by steeping it twelve hours in the solution of tin, diluted with eight parts of water, then left all night in the solution of alum, washed, dried, and passed through the two baths of cochineal, taking care to add to the second bath a small quantity of sulphuric acid. The same colour may be produced by dyeing the silk previously with anotta, and then passing it successively through a number of baths prepared with an alkaline solution of carthamus, to which lemon juice has been added, till it acquire a fine cherry-colour. To brighten the colour, the silk, after being dyed, may be immersed in hot water acidulated with lemon juice.

Other shades of red, as a cherry red, and flesh red, are also produced by carthamus. For a cherry red it is not necessary that the stuff be previously dyed with anotta,

With co-
chineal.

Poppy red.

Cherry
red, &c.

Simple
Colours.

and the proportion of colouring matter is smaller. A flesh-red colour is obtained by adding a little soap to the bath, which has the effect of softening the colour, and of retarding the action of the colouring matter on the stuff. To produce dark shades, it is sometimes usual to mix archil, and by this means the expense is diminished.

Scarlet.

Those who have produced a colour on silk which comes nearest to scarlet, Berthollet observes, begin with dyeing the silk crimson. It is then dyed with carthamus, and lastly it is dyed yellow without heat. By this process a fine colour is obtained; but the dye of the carthamus is not permanent, as it is destroyed by the action of the air, and the colour becomes deeper. The following is Dr Bancroft's process. In a solution of murio-sulphate of tin, diluted with five times its weight of water, the silk is to be soaked for two hours; and after being taken out, it is to be wrung and partially dried. It is then to be dyed in a bath prepared with four parts of cochineal and three of quercitron bark. In this way a colour approaching to scarlet is obtained. To give the colour more body, the immersion may be repeated both in the solution of tin and in the dyeing bath; and the brightness of the scarlet is increased by means of the addition of carthamus. A lively rose colour is produced by omitting the quercitron bark, and dyeing the silk with cochineal only; and by adding a large proportion of water to the cochineal, a yellow shade is obtained, which changes the cochineal to the compound scarlet colour.¹

Rose co-
lour.

IV.—Method of dyeing Cotton and Linen Red.

The dyestuff usually employed to give a red colour to cotton and linen is madder. It is easier to dye cotton than linen; but as the processes are the same for each, one general description will apply to both. There are two kinds of madder red; the one is called *simple* madder red, and the other, which was originally invented in the Levant, is distinguished in this country by the name of *Turkey red*. This last constitutes by far the brightest and most beautiful and permanent red which is communicated to cotton; we shall therefore proceed to give a somewhat particular account of the process.

The method was first put in practice in Glasgow about forty years ago, by M. Papillon, a French gentleman, who established a Turkey-red dye-work along with Mr Mackintosh. He made an agreement with the commissioners and trustees for manufactures in Scotland, that the process was to be by them published for the benefit of the public at the end of a certain term of years. The period agreed upon having expired in 1803, the trustees laid a minute account of the different processes before the public. Since that period Turkey-red dyeing has been conducted in Glasgow upon a very extensive scale. Different individuals, possessed of both chemical skill and considerable sagacity, have studied the different parts of this very complicated method of dyeing. The effects of each individual operation have been carefully investigated, and the whole has been somewhat shortened and simplified, though it still constitutes the most complicated process in the whole art of dyeing. The Turkey-red dye is practised by a considerable number of persons in Glasgow; but the oldest, and perhaps the most extensive establishment, is that of Henry Monteath and Company at Rutherglen Bridge. The character of that house has been long established, and the beauty of their Turkey-red dye is known and appreciated in every part of the globe where British manufactures are known. From

Glasgow the Turkey-red dye has gradually made its way into Lancashire.

Simple
Colours.

Cotton cloth which is to receive the Turkey-red dye is never bleached beforehand; because it has been found that the first parts of the processes succeed better with unbleached than with bleached cloth.

1. The first step of the dyer is to remove the weaver's dressing. This is done by steeping the cloth in a weak alkaline ley. To this the technical name of the *rot steep* is given. From four to five pounds of caustic potash are generally employed for every 100 lbs. of cotton cloth. The temperature of the solution is from 100° to 120°, and the cloth is kept in the steep for twenty-four hours, and then well washed.²

2. From seven to ten pounds of carbonate of soda are dissolved in a sufficient quantity of water to keep the cloth (supposed always to weigh 100 lbs.) wet. In this ley the cloth, previously deprived of the weaver's dressing, is boiled for some time.

3. The process which we are now going to describe is the one upon which the goodness of the Turkey-red dye depends more than upon any of the others. Without it the dye cannot be produced upon new cloth; but when cloth which has been frequently washed with soap is to be dyed (an old cotton shirt, for example), this process may be omitted altogether. It is evident from this that soap communicates to cotton cloth the same properties as the process which we are now going to describe.

A liquor is composed of the following ingredients:

- 1 gallon of gallipoli oil,
- 1½ gallon of soft sheep dung,
- 4 gallons of solution of carbonate of soda, of the specific gravity 1.06,
- 1 gallon of solution of pearl ash, of the specific gravity 1.04,

mixed with a sufficient quantity of cold water to make up twenty-two gallons. The specific gravity of this liquor should be from 1.020 to 1.025.

This liquor has a milk-white appearance, and is in fact a kind of incipient soap. It is put into a large wooden open cylindrical vessel, called the *liquor tub* (see Plate CCVI. fig. 1 and 2), and is kept continually in a state of agitation by a kind of wooden levers, driven round in it by machinery put in motion by the steam-engine. This liquor is conveyed by a tin pipe to the *padding machine*, which is situated in an apartment below. Several sections of this machine are given in the same plate, fig. 3, 4, and 5. A kind of trough in this machine is kept always full of the milky liquor, and the pieces of cloth to be dyed are made to pass through this liquid, and are thoroughly soaked with it.

By this process the cloth is impregnated with the soapy matter, and the longer this matter is left undisturbed on the cloth, the better does it take the dye. Fourteen days is the least period that this impregnation is allowed to remain.

The sheep dung gives the cloth a dark-green colour, and is found materially to assist the bleaching which the cloth afterwards undergoes. This bleaching goes on much more rapidly with than without the sheep dung, especially when the cloth is exposed on the grass between the different operations. In what way the sheep dung contributes to this acceleration has not been determined, but the fact is certain.³

4. When the weather is favourable, the cloth, after be-

¹ *Philosophy of Permanent Colours*, 312.

² In general the alkaline ley of No. 9 is worked up in this process, and when this is done less potash is required.

³ No advantage has been found to result from using the alkalies caustic in this process; and a mixture of potash and soda answers much better than soda alone.

Simple
Colours.

ing impregnated with the oleaginous liquor, is spread upon the grass to dry. But should the weather be rainy, as it would not do to allow the oleaginous liquid to be washed out by the rain, the goods are dried in the stove.

5. After the cloth has been dried in the stove, it is a second time impregnated with the oleaginous liquid described in No. 3, by means of the padding machine. It is then spread on the grass for some hours if the weather be favourable, and ultimately dried in the stove.

The impregnation with the oleaginous liquor, the exposure on the grass, and the stove drying, are repeated a third time. When the weather is rainy, which prevents exposure on the grass, and obliges the workmen to dry the cloth at once in the stove, the impregnation with the oleaginous liquor is sometimes repeated a fourth time.

Upon the sides of the tubs in which the oleaginous liquor is kept, a white solid crust gradually accumulates. This matter being examined, was found to consist almost entirely of phosphate of lime. It was doubtless derived from the sheep dung with which the saponaceous liquid was mixed.

6. The next process is to steep the cloth in a weak solution of pearl ash, of the specific gravity 1.0075 to 1.01, heated to the temperature of 120°. From this liquor it is wrung out and again dried.

7. A mixture is now made of the following substances:

1 gallon gallipoli oil,
3 gallons soda ley of specific gravity 1.06,
1 gallon caustic potash ley of specific gravity 1.04,
diluted with as much water as will make up the whole to twenty-two gallons. In this liquid, which is milky, like the preceding, and which contains an imperfect soap, the cloth used formerly to be tramped with the hand, and then wrung out. It is now soaked with the liquid by means of the padding machine, in the manner described under No. 3.

If the weather be fine, the cloth thus impregnated with the soap is exposed on the grass. It is then dried in the stove.

8. The above process (No. 7) is repeated thrice; and after each soaking in the saponaceous liquor, the cloth is exposed on the grass for some hours, and then dried in the stove.

9. The cloth, thus so many times soaked in the saponaceous liquor, is now steeped in a mixed ley of pearl ash and soda of the specific gravity from 1.01 to 1.0125, heated to the temperature of 120°. After being taken out of the steep, and allowed to drain for a few hours (taking care to preserve the liquor), the cloth is well washed. The object of this process is to remove any superfluous oil with which the cloth may be impregnated, the object being that all the oil adhering to the cloth should be in combination with an alkali. About half the alkali used in this process disappears during the steeping. The remaining liquor, which is about half as strong as at first, is reserved for future use. The cloth thus washed clean is dried in the stove.

The gall-
ing.

10. The preceding washing is necessary for the success of the next operation, called the *galling*; for the nutgall liquor will not be imbibed by the cloth unless it be thoroughly freed from all uncombined oil, which would give it a greasy feel. If the first steeping in alkali and washing has not fully accomplished this necessary object, they ought to be repeated.

For the galling, eighteen pounds of Aleppo galls are to be boiled for four or five hours in twenty-five gallons of water till it is reduced to about twenty gallons; and the liquid being now passed through a sieve, is sufficient for impregnating 100 lbs. of cloth with the requisite quantity of nutgalls. Of late years, sumach from Sicily has been

substituted for nutgalls, thirty-three lbs. of sumach being considered as equivalent to eighteen lbs. of nutgalls. Sometimes a mixture of nine lbs. nutgalls and sixteen and a half lbs. of sumach is employed.

Through this decoction the cloth is either tramped by the hand, or it is passed and soaked in it by means of the padding machine. The temperature of the decoction should be from 80° to 100°. It is unnecessary to steep the cloth in the gall liquor; a complete soaking is all that is necessary. The cloth, thus soaked in a decoction of fustic, comes out dyed yellow, a colour which serves to improve the madder red by rendering it more lively.

11. The next process is to fix the alumina mordant upon the cloth. This step is essential, because without it the madder dye would not remain fixed in the cloth, but would be easily washed out. Accordingly the depth of the shade of red depends entirely upon the quantity of alumina fixed on the cotton. In a preceding part of this article we have stated the quantity of alumina fixed by this process upon the surface of a square yard of cloth.

In this country common alum is usually employed; but in many parts of the Continent they use acetate of alumina. The high price of that article prevents its employment in Britain. Acetate of alumina, however, is made in this country by the chemical manufacturers, and largely used by the calico-printers. It is made by mixing acetate of lime (obtained by saturating the acetic acid formed when wood is distilled with lime) with a solution of alum, and afterwards drawing off the clear liquor; or by mixing acetate of lead with solution of alum, though that process is more expensive.

Alum (as has been explained under the article ALUM) is a double salt, composed of

3 atoms sulphate of alumina,
1 atom sulphate of potash,
25 atoms water.

To form the alum liquor used by the Turkey-red dyers: To a solution of alum in water of the specific gravity 1.04 as much pearl ash, soda, or chalk is added as is sufficient to precipitate the alumina contained in the alum. Through this muddy liquor, which should have a temperature of from 100° to 120°, the cloth is passed and steeped for twelve hours. The alumina, in the state of extreme division which it has when thus newly precipitated, is readily imbibed by the cloth, and unites with the fibres of the cotton.

12. The cloth thus united to alumina is stove dried, and then washed out of the alum liquor.

13. These essential preliminary steps having been taken, the cloth is ready for being dyed.

From one to three lbs. of madder reduced to the state of powder for every pound of cloth is employed, the quantity depending upon the shade of colour wanted. The cloth is entered into the boiler when the water is cold. It is brought to boil in one hour, and the boiling is continued for two hours. During the whole of this time the cloth is passed through the dyeing liquor by means of the winch.

For every twenty-five lbs. of cloth dyed, one gallon of bullock's blood is added. This is the quantity of cloth dyed at once in a boiler. This addition of blood is indispensable for obtaining a fine red colour. Various attempts have been made to dispense with the use of blood in Turkey-red dyeing, but hitherto they have been unsuccessful. No satisfactory explanation of the way in which the blood acts has been given. For our own parts, we are disposed to consider the colouring matter of the blood as the useful ingredient. It is probably fixed upon the cloth to a certain extent, and by its fine scarlet tint it is obvious that it must improve the colour of madder red.

Simple
Colours.The alum-
ing.The dye-
ing.

Simple
Colours.

14. After the cloth has been thus dyed, it was formerly customary to steep it in a solution the same as that described in No. 7. This was called the *cuing* process. It is now generally dispensed with, and is unnecessary if the cloth has been well cleaned before the galling process. The object of it is merely to dissolve any greasy matter which may continue attached to the cloth, and to form a soap with it, which assists in the subsequent process.

The clearing.

15. Madder contains two colouring matters, a brown and a red. Both are fixed upon the cloth by the dyeing process. The consequence is, that the cloth has a dirty brownish-red colour, which is any thing but agreeable. Fortunately the brown colouring matter is not nearly so fixed upon the cloth as the red colouring matter. The next process, called the *clearing process*, is to get rid of the brown colouring matter. For this purpose the cloth is boiled from twelve to fourteen hours, in a mixture of five pounds of soda, eight pounds of soap, and sixteen to eighteen gallons of the residual liquor of No. 9, with a sufficient quantity of water. These quantities are supposed to be employed to clear a hundred pounds of cloth. By this process the brown colouring matter is almost wholly removed, and the cloth begins to assume the fine tint which distinguishes Turkey-red dyed cloth.

16. The next process serves not merely to remove the brown colouring matter more completely, but also to improve the shade of red. Five or six pounds of soap, and from sixteen to eighteen ounces of protochloride of tin, in crystals, are dissolved in water, in a globular boiler, into which the cloth is put. The boiler is then covered with a lid which fits close, and the boiling is conducted under the pressure of two atmospheres, or at the temperature of $250\frac{1}{2}^{\circ}$. The boiler is furnished with a safety valve and a small conical pipe, the extremity of which has an aperture about $\frac{5}{16}$ ths of an inch in diameter, from which there issues a constant stream of steam during the operation. We have given a section and elevation of this boiler in Plate CCVII. fig. 8 and 9, and in fig. 10 a plan of its top, and in fig. 11 of its lid. The use of the salt of tin is to give a shade of scarlet to the cloth. The oxide of tin seems to combine with the oleaginous acid of the soap, and this insoluble soap unites with the red colouring matter of the madder fixed upon the cloth, and improves the shade of colour.

17. After these processes, the cloth is spread out on the grass and exposed to the sun for a few days, which finishes the clearing. It is seldom that recourse is had to a bleaching liquor, consisting of a solution of chloride of lime in water, especially when a salt of lime is used in the clearing process. When this method is employed, however, one gallon of the solution of chloride of lime, of the specific gravity 1.015, is mixed with twenty gallons of pure water. The cloth is immersed in this dilute solution from five to ten minutes, which is sufficient for completing the clearing.

Remarks
on the
processes.

Such are the different steps in fixing this beautiful and permanent colour, as practised in the principal works in Glasgow. Many attempts have been made to shorten these tedious processes, but hitherto these attempts have been unsuccessful. The impregnation with oil, or rather with soap, is essential, as is evident from this, that if one, two, or three of these operations be omitted, the red is inferior in proportion to the number of omissions.

Cloth bleached by chloride of lime does not produce a good red. Probably the fibres of the cotton wool are combined with lime, or rather sulphate of lime, which, by decomposing the oleaginous soap, prevents it from being deposited upon and combining with the cloth. But cloth bleached by the old process, namely, boiling in ley or soap, and exposing to the action of the sun, answers perfectly, and will produce as good a red as when unbleached cloth

is used; but there would result no saving from bleaching the cloth in this way before commencing the impregnation with the oleaginous soap, because the bleaching is effected betwixt the oil operations by exposing the cloth on the grass.

Simple
Colours.

The colour would be as good without the galls or sumach as with them. But there would be considerable difficulty in sufficiently impregnating the cloth with the solution of alum without its being previously passed through the gall decoction, and more particularly if the cloth be in the least degree greasy. The use of the galls, then, is to facilitate the fixation of the alumina upon the cloth.

Alumina is essential to the fixation of the colour; for without it the madder dye would be fugitive, and would disappear whenever the cloth was washed. The subsequent *clearing* operations would completely remove both the colouring matters of the madder, unless it were cleared along with a quantity of cloth that had received alumina, and been dyed a deep red. In that case the unalumed cloth will receive a little alumina from the alumed portion. This will serve to fix the colour; but as the quantity of alumina which in such a case is imbibed is very small, the red colour will be very pale. It is in this way that the two shades of red, the deep and the pale, which are often seen upon garments and furniture dyed Turkey red, are given. These two shades, by their contrast, frequently add considerably to the beauty of the pattern. The fustic, as well as the tin, probably serves to render the red colour more lively by the shade of yellow which they superinduce.

The three essential processes in the Turkey-red dyeing are, the impregnation with oleaginous soap, the impregnation with alumina, and the dyeing with madder. The last communicates the colour, the second fixes the colour, and the first gives beauty to the colour.

For the better understanding of the Turkey-red processes, we have got drawings made of the principal machinery used.

Fig. 1 and 2, Plate CCVI., exhibit a section and plan of the *liquor tub*, in which the mixture of oil and alkali is put, with its agitators to prevent the oil from separating and swimming on the surface. From the liquor tub (which is placed in an upper room) the liquor passes by a tin pipe to the padding machine, represented in various ways in figs. 3, 4, and 5.

It consists essentially of a box for holding the liquor, through which the cloth passes; and afterwards it goes between two rollers, the distance between which regulates the quantity of liquor which the cloth retains.

a, is the lapper for folding the cloth.
b, a compound lever for regulating the pressure.
c, the box for containing the liquor.
d, a frame or *scrae* for laying the cloth on before it passes through the liquor.
e, pulleys for moving the lapper; and
f, the cylinders between which the cloth passes. They regulate, by their distance from each other, the quantity of liquor allowed to remain in the cloth.

Figs. 6 and 7 represent the elevation and plan of a *dyeing box* on the latest and most improved construction.

a, the winch for moving the cloth through the liquor while dyeing.

b, steam pipe for supplying the vessel with steam.

c, c, c, the dotted part, represents the valves through which the steam enters into the vessel.

d, d, d, d, divisions of the vessel for different pieces of cloth.

e, catch for stopping or setting on the winch at pleasure.

f, valve for regulating the quantity of steam admitted.

Simple Colours.

Simple Colours.

Figs. 8 and 9 represent a section and elevation of the clearing boiler. Fig. 10 represents exactly the mouth of this boiler, and fig. 11 the lid or cover. On the upper edge of this cover there is fixed all round a layer of hemp (a piece of flat rope). The lid is slipped into the inside of the boiler, and by the piece of rope it attaches itself exactly to the inside. The elasticity of the steam within presses it firmly against the inside rim of the mouth, and renders it quite steam-tight.

Scarlet with cochineal.

The scarlet colour communicated to cotton by means of cochineal is far from being permanent; but if this colour is wished to be communicated to cotton, Dr Bancroft recommends to steep the cotton, previously moistened, for half an hour, in a diluted solution of murio-sulphate of tin, and then having wrung the cotton, to plunge it into water in which as much potash has been dissolved as will neutralize the acid adhering to the cotton, so that the oxide of tin may be more copiously fixed on the fibres of the cotton. The stuff being afterwards rinsed in water, may be dyed with cochineal and quercitron bark, in the proportion of four pounds of the former to two and a half or three pounds of the latter. A full bright colour is thus given to the cotton, which will bear slight washings with soap, and exposure to the air. Indeed the yellow part of the colour derived from quercitron bark will bear long boiling with soap, and will resist the action of acids.

Crimson.

With the aluminous mordant, as it is usually applied by calico-printers for madder reds, cotton dyed with cochineal receives a beautiful crimson colour, which will bear several washings, and resist the weather for some time. It is not, however, to be considered as a fixed colour. Dr Bancroft is of opinion that the addition of a small portion of cochineal in dyeing madder reds upon the finer cottons, would be highly advantageous to the calico-printers. By this addition the madder reds are rendered more beautiful, and the fawn colour, or brownish-yellow hue, which injures these colours, would be thus overcome.¹

SECT. II.—Of Yellow.

All the yellow dyes, as well as the red, require a mordant to fix them on the cloth; and the usual mordant employed is alumina. As in the last section, we shall in the first place give an account of the dyestuffs usually employed for giving a yellow colour to cloth, and then give a sketch of the methods employed for giving a yellow colour to wool, silk, cotton, and linen.

I.—Description of the Dyestuffs.

The principal colouring matters used in dyeing yellow are *weld*, *fustic*, *catechu*, *anotta*, and *quercitron*. We shall give a short account of these dyestuffs in succession.

Substances employed in dyeing yellow. Weld.

1. *Weld*, in French *gaud* or *vaud*, is the dried leaves and stems of the *reseda luteola*, a plant which grows wild in Britain, and in different European countries. Its leaves are long, narrow, and of a bright green, but the whole plant is made use of in the dyeing of yellow. There are two kinds of weld, cultivated and wild, the former of which is deemed more valuable than the latter, as it yields a much greater proportion of colouring matter. When this plant is fully ripe, it is pulled, dried, and bound up in bundles for the use of the dyer. The wild species grows higher and has a stronger stalk than that which is

cultivated, by which the one may be readily distinguished from the other.

A decoction of this plant, if strong, has a brownish-yellow colour, and when diluted with water, it acquires a shade of green. The acids render this colour more pale, while alkalies, common salt, and sal ammoniac, render it deeper; and when sufficient quantities of these substances are dissolved in the decoction, a deep-yellow precipitate falls. A solution of alum or of protochloride of tin throws down a fine yellow lake; sulphate of iron occasions a black precipitate, and sulphate of copper a brownish-green precipitate.

Chevreul has discovered in weld a yellow colouring matter, to which he has given the name of *luteolin*. It may be sublimed, and in that case it crystallizes in needles, which are transparent, and have a pale-yellow colour. Luteolin dissolves in water, but the solution has little colour; yet silk or woollen previously impregnated with alumina, if passed through it, acquires a fine yellow colour. It is soluble in alcohol and ether. It combines with acids, but still more readily with bases. The compound which it forms with potash has a golden-yellow colour; but when exposed to the air it assumes first a shade of green, and then passes into brown. The compounds of luteolin with the other bases are easily obtained by double decomposition.

The yellow colour communicated by weld is more permanent than that communicated by quercitron or by old fustic.

2. *Fustic*² is the name given by the dyers in Great Britain to the wood of the *morus tinctoria*, a tree which grows in the West Indies, and probably also in South America. In France it is distinguished by the name of *bois jaune*. The wood is yellow, as its name imports, with orange veins. Ever since the discovery of America it has been used in dyeing, as appears from a paper in the Transactions of the Royal Society, of which Sir William Petty was the author. Its price is moderate, the colour it imparts is permanent, and it readily combines with indigo, which properties give it a claim to attention as a valuable ingredient in dyeing. Before it can be employed as a dyestuff, it must be cut into chips and put into a bag, that it may not fix in, and tear the stuff, to which it is to impart its colouring matter.

When a decoction of yellow wood or fustic is made very strong, the colour is of a reddish yellow, and when diluted it is of an orange yellow, which it readily yields to water. It becomes turbid by means of acids, its colour is of a pale yellow, and the greenish precipitate may be re-dissolved by alkalies. The sulphates of zinc, iron, and copper, as well as alum, throw down precipitates composed of the colouring matter and the different bases of the salts employed.

Chevreul discovered in fustic a yellow uncrystallizable colouring matter, to which he has given the name of *morin*. It restores the colour of turmeric paper reddened by lime. It is but little soluble in water, even when boiling hot. Alcohol is a better solvent of it than water, and ether still better than alcohol. When the alcoholic or ether solutions are evaporated, they deposit yellow crystals. The aqueous solution is rendered muddy by gelatine. The solutions of the fixed alkalies and alkaline earths give the aqueous solution a fine yellow colour,

¹ *Philosophy of Permanent Colours*, 317.

² The origin of the word *fustic* is not very well understood. The French applied the term *Fustet* to the *rhys cotinus* or *Venice sumach*, which yields fugitive and bad yellow. Bancroft supposes that *fustic* is merely a corruption of the word *fustet*. When the *morus tinctoria* was introduced, about a couple of centuries ago, being the wood of a large tree, it was called *old fustic*, while the *rhys cotinus*, being only a shrub, was called *young fustic*. *Rhus cotinus* being now hardly used by dyers, the term *fustic* has been assigned to the wood of the *morus tinctoria*.

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without occasioning any precipitate. Alum causes it to assume a greenish-yellow colour. The sulphated peroxide of iron renders it green, and then throws down a precipitate. Concentrated sulphuric acid increases the intensity of the yellow colour, while nitric acid gives it a reddish shade, and renders it muddy. Boiling nitric acid converts it into oxalic acid. By combining with oxygen it seems to assume a red colour. Morin, when distilled, yields a liquid, which crystallizes as it cools, and furnishes a number of yellowish-brown needles. According to the experiments of George, boiling water extracts from fustic 0.15, and alcohol 0.09 of matter; and the wood is composed of

Lignin.....	74
Morin.....	9.1
Tannin.....	4
Gum.....	2
Resin.....	9
	98.1

3. *Catechu*, or *terra japonica*, comes from the East Indies, and is the inspissated decoction of certain plants containing tannin, but principally of the *areka nut*, the wood of *mimosa catechu*, the leaves of the *nauclea catechu*. Areka nuts, cut into small pieces, are sprinkled in an earthen vessel with water holding saltpetre in solution. A portion of the bark of kantai-babela (a species of mimosa) is added. The vessel is closed by a lid luted down with clay, that the temperature may be the higher. After an ebullition of two hours, the fire is gradually diminished during five or six hours. When the vessel is cold the areka nuts are taken out, and the decoction is evaporated down to the consistency of a syrup. It is then kneaded into small balls, and left to dry in the shade.

Constitu-
ents.

The principal constituents of catechu are tannin and extractive. The former may be thrown down by gelatine, the latter remains in solution. It has a reddish-brown colour and a sweetish taste. In India catechu is employed in dyeing and calico-printing. The colours which it gives are very various, depending upon the nature of the mordants employed along with it; but they are all very fixed. With verdigris and sal ammoniac the colour is brown; with protochloride of tin yellow; with perchloride of tin a brown, or, if nitrate of copper be added, a deep bronze; with nitrate of alumina a copper red; with nitrate of iron a deep brownish gray.

We are not aware that catechu is employed in this country, either by the dyers or calico-printers; but it is entitled to their attention, both on account of its cheapness, and the permanency and variety of the colours which it gives.

4. *Anotta*, in French *rocou*, is a species of paste of a red colour, obtained from the berries of the *bixa orellana*, Lin. which is a native of America. The anotta of commerce is imported from America to Europe in cakes of two or three pounds weight, where it is prepared from the seeds of the tree mentioned above; but the Americans are said to be in possession of a species of anotta superior to that which they export, both for the brilliancy and permanency of the colour it imparts. They bruise the seeds with their hands moistened with oil, separating with a knife the paste as it is formed, and drying it in the sun; but the seeds are pounded with water when designed for sale, and allowed to undergo the process of fermentation.

According to John, the cakes of anotta are composed of twenty-eight parts of resin mixed with colouring matter, twenty parts of coloured extractive, twenty-six of gum, and twenty of lignin, mixed with an acid and an aromatic substance.

The colouring matter of anotta is but little soluble in

water, though it communicates a yellow colour to that liquid. It is more soluble in alcohol, and tinges it orange. Ether dissolves it still better, and assumes also an orange colour. We obtain the colouring matter in a sufficiently pure state by evaporating the alcoholic solution to dryness, treating the residue with ether, and finally distilling off the ether. It is a reddish-brown substance, heavier than water, soft and adhesive. Even when exposed to a very low temperature, it does not become brittle. When heated it melts, and when sufficiently heated in an open vessel it takes fire and burns like a resin.

We may likewise obtain the colouring matter of anotta by digesting it in a caustic alkaline solution, and then saturating the alkali by an acid. The colouring matter precipitates in orange flocks. Concentrated sulphuric acid gives anotta an indigo-blue colour; but in contact with air this colour soon passes into green, and then into violet brown. Cold nitric acid does not alter the colour of anotta but if the quantity of acid be small, the mixture assumes the consistence of a syrup, and detonates when slightly heated, leaving charcoal. Anotta gives an orange-red colour to oils, both fixed and volatile.

According to Chevreul, anotta contains two different colouring matters, the one yellow and the other red. The yellow colouring matter is soluble in water and alcohol, and slightly in ether; the red colouring matter is scarcely soluble in water, but it dissolves in alcohol and ether, communicating to these liquids an orange-red colour.

Anotta yields an orange precipitate with a solution of alum, and the sulphates of copper and iron produce effects of nearly a similar nature. With a solution of tin the precipitate is of a lemon colour, and slowly deposited.

It is employed both for dyeing silk and cotton, but the colours which it yields have little permanency.

5. *Quercitron bark*.—Quercitron, as it is denominated by Dr Bancroft, is the *quercus nigra* of Linnæus, and is a large tree which grows spontaneously in North America. The bark of it yields a considerable quantity of colouring matter, which was first discovered by Dr Bancroft in the year 1784, in whom the use and application of it in dyeing were exclusively vested for a certain term of years by virtue of an act of parliament. To prepare it for use, the epidermis is taken off and pounded in a mill, the result of which process is a number of filaments and a fine light powder; but as these do not contain equal quantities of colouring matter, it will be proper to employ them in their natural proportions.

Quercitron bark contains a good deal of tannin, and a yellow colouring matter capable of being extracted by water. The aqueous solution, when evaporated to dryness, leaves a quantity of extract, amounting to eight per cent. of the weight of the bark employed. The tannin is that variety which forms a green precipitate with oxide of iron. Its presence is injurious to the beauty of the yellow colour, because it is precipitated by the same re-agents as the colouring matter itself, and of course communicates to it a shade of brown. To free the colouring matter from tannin, ox bladder steeped in water, and deprived of every thing soluble in cold water, is introduced into the quercitron infusion. With this substance the tannin gradually unites, and thus is removed from the solution. It may be thrown down also by a solution of gelatine.

When the infusion of quercitron is gently concentrated, the colouring matter is deposited in crystals, which have a pearly lustre as long as they continue suspended in the liquid. To this colouring matter Chevreul has given the name of *quercitrin*. It restores the yellow colour of turmeric paper reddened by an alkali. It is but little soluble in ether, more soluble in alcohol, and still more soluble in water. The aqueous solution is tinged orange by al-

Simple
Colours.
Its colour-
ing matter.

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kalies. The acetates of lead and copper, and the protochloride of tin, throw it down in yellow flocks. The sulphated peroxide of iron gives it an olive-green colour, and then precipitates it. Sulphuric acid dissolves quercitrin, the solution is orange with a shade of green, and is rendered muddy when mixed with water. When quercitrin is subjected to distillation, it yields, among other products, a liquid which speedily deposits yellow crystals possessing the characters of quercitrin.

Other substances.

Besides the substances already mentioned as employed in the dyeing of yellow, we may add saw-wort to the number (*serratula tinctoria*, Lin.), a plant which yields a colouring matter nearly similar to that of weld, and may of consequence be used as a proper substitute. Dyers' broom (*genista tinctoria*) produces a yellow of very indifferent nature, and is therefore only employed in dyeing stuffs of the coarsest kind. Tumeric (*curcuma longa*) is a native production both of the East and West Indies, and yields a more copious quantity of colouring matter than any other yellow dyestuff; but it will probably never be of any essential service in dyeing yellow, as no mordant has yet been discovered capable of giving permanency to its colour.

Chamomile (*anthemis tinctoria*) yields a faint yellow colour, the hue of which is not unpleasant, but is far from being durable, and even mordants are not capable of fixing it. Sulphate of lime, tartar, and alum, bid fairest for success.

Fenugreek (*trigonella fenugracum*) yields seeds which, when ground, communicate to stuffs a pale yellow of tolerable durability; and the best mordants are found to be alum and muriate of soda, or common salt. American hickory (*juglans alba*) is a tree, the bark of which yields a colouring matter in every respect resembling that of the *quercus nigra*, but in quantity greatly inferior. French berries (*rhamnus infectorius*) produce a tolerable yellow colour, but it is by no means permanent. When used in the process of dyeing, they are to be employed in the same manner as weld. According to Scheffer, a fine yellow colour may be imparted to silk, thread, and wool, by means of the leaves of the willow; but Bergman informs us that only the leaves of the sweet willow (*salix pentandra*) are proper for producing a permanent colour, as a few weeks' exposure to the sun extracts that which is produced by the colouring matter from the leaves of the common willow.

In Switzerland and in England the seeds of purple trefoil are sometimes employed in the art of dyeing, on which Vogler made a number of experiments, in order to ascertain what colours they would produce; and he found that a fine deep yellow was afforded by a bath made of a solution of these seeds with potash; that sulphuric acid yielded a light yellow, and sulphate of copper or blue vitriol a yellow inclining to green. M. Dizé informs us that the seeds of trefoil impart to wool a beautiful orange, and to silk a greenish yellow; and that while aluming is necessary in the process of dyeing with the seeds of trefoil, a solution of tin cannot be employed.

Many other vegetable substances are occasionally employed in dyeing yellow, but it seems useless to enumerate them. Saffron and turmeric yield exceedingly beautiful but fugitive yellows. The colouring matter of saffron (*crocus sativus*) is extremely rich; it has been subjected to a chemical examination, and distinguished by the name of *polychroite* by Bouillon La Grange and Vogler, to whom we are indebted for the first examination of it.

The finest and most fixed of all the yellows on cotton is chromate of lead. It is employed abundantly by the calico-printers, but scarcely by the dyers in general. On

that account we think it better to reserve it till we come to that part of this article in which we propose to describe the processes followed by the calico-printers.

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II.—Of the Processes for dyeing Wool Yellow.

In dyeing woollen stuffs with weld, the mordants employed are alum and tartar, and by their means a pure, permanent yellow is obtained. The boiling is to be conducted in the usual way; and, according to Hellot, four ounces of alum to one ounce of tartar are to be employed. Other dyers, however, employ half as much tartar as alum. The colour is rendered paler, but more lively, by means of the tartar.

The bath is prepared by boiling the plant inclosed in a thin linen bag, and keeping it from rising by means of a wooden cross. Some boil it till it sinks to the bottom of the vessel; while others, after it is boiled, take it out and throw it away. From three to four pounds of weld, and sometimes less, are allowed for every pound of stuff; but the quantity must be regulated by the intensity of the shade desired. Some dyers add a small quantity of quicklime and ashes, which are found to promote the extraction of the colouring matter. These substances at the same time heighten the colour, but render it less susceptible of resisting the action of acids.

With other additions, and different management, different shades may be obtained. Thus lighter shades are produced by dyeing after deeper ones, adding water at each dipping, and keeping the bath at the boiling temperature. These shades, however, are less lively than when fresh baths are employed, with a suitable proportion of weld. The addition of common salt or sulphate of lime to the weld bath communicates a richer and deeper colour. With alum it is paler and more lively, with tartar still paler, and with sulphate of iron the shade inclines to brown. According to Scheffer, by boiling the stuff two hours, with one fourth of its weight of a solution of tin, and the same proportion of tartar, and then washing and boiling it with an equal weight of weld, a fine yellow is produced; but if the stuff be in the state of cloth, its internal texture is not penetrated. Poerner recommends a similar preparation as for dyeing scarlet, and by these means the colour is brighter, more permanent, and lighter.

Dr Bancroft recommends the quercitron bark as one of the cheapest and best substances for dyeing wool yellow. The following is the simple process which he has proposed for its application. The bark is to be boiled up with about its weight, or one third more, of alum, in a suitable proportion of water, for about ten minutes. The stuff previously scoured is then to be immersed in the bath, taking care to give the higher colours first, and afterwards the paler straw colours. By this cheap and expeditious process, colours which are not wanted to be of a full or bright yellow may be obtained. The colour may be considerably heightened by passing the unrinsed stuff a few times through hot water, to which a little clean powdered chalk, in the proportion of about a pound and a half for each 100 lbs. of stuff, has been previously added. The bark, when used in dyeing, being first reduced to powder, should be tied up in a thin linen bag, and suspended in the liquor, so that it may be occasionally moved through it, to diffuse the colouring matter more equally.

But although the above method possesses the advantages of cheapness and expedition, and is fully sufficient for communicating pale yellows; to obtain fuller and more permanent colours, the common mode of preparation, by previously applying the aluminous mordant, ought to be preferred. The stuff, therefore, should be boiled for about one hour or one hour and a quarter, with one sixth or one eighth of its weight of alum dissolved in a proper pro-

Process for permanent colours.

Simple
Colours.

portion of water. The stuff is then to be immersed, without being rinsed, into the dyeing bath, with clean hot water, and about the same quantity of powdered bark tied up in a bag as that of the alum employed in the preparation. The stuff is then to be turned as usual through the boiling liquor, until the colour appears to have acquired sufficient intensity. One pound of clean powdered chalk for every 100 lbs. of stuff is then to be mixed with the dyeing bath, and the operation continued for eight or ten minutes longer. This addition of the chalk raises and brightens the colour.

For differ-
ent shades.

Orange Yellow.—To communicate a beautiful orange yellow to woollen stuffs, ten lbs. of quercitron bark, tied up in a bag, for every 100 lbs. of stuff, are to be put into the bath with hot water. At the end of six or eight minutes, an equal weight of murio-sulphate of tin is to be added, and the mixture well stirred for two or three minutes. The cloth, previously scoured, and completely wetted, is then immersed in the dyeing liquor, and briskly turned for a few minutes. By this process the colouring matter fixes on the cloth so quickly and equally, that after the liquor begins to boil, the highest yellow may be produced in less than fifteen minutes.

High shades of yellow, somewhat similar to those obtained from quercitron bark by the above process, are frequently given with young fustic (*rhus cotinus*, Lin.), and dyers' spirit, or nitro-muriate of tin; but this colour is much less beautiful and permanent, while it is more expensive, than what is obtained from the bark.

Bright Golden Yellow.—This colour is produced by employing ten pounds of bark for every 100 pounds of cloth, the bark being first boiled a few minutes, and then adding seven or eight pounds of murio-sulphate of tin, with about five pounds of alum. The cloth is to be dyed in the same manner as in the process for the orange yellow.

Bright yellows of less body are produced by employing a smaller proportion of bark, as well as by diminishing the quantity of murio-sulphate of tin and alum. And indeed every variety of shade of pure bright yellow may be given by varying the proportions of the ingredients.

For green-
ish yellow.

To produce the lively delicate green shade, which, for certain purposes, is greatly admired, the addition of tartar, with the other ingredients, only is necessary, and the tartar must be added in different proportions, according to the shade which is wanted. For a full bright yellow, delicately inclining to the greenish tinge, it will be proper to employ eight pounds of bark, six of murio-sulphate of tin, with six of alum, and four of tartar. An additional proportion of alum and tartar renders the yellow more delicate, and inclines it more to the green shade; but when this lively green shade is wanted in the greatest perfection, the ingredients must be used in equal proportions. The delicate green lemon yellows are seldom required to have much fulness or body. Ten pounds of bark, therefore, with an equal quantity of the other ingredients, are sufficient to dye three or four hundred pounds of stuffs.¹

For pale
green yellow.

To produce the exquisitely delicate and beautiful pale green shades, the surest method, Dr Bancroft observes, is to boil the bark with a small proportion of water, in a separate tin vessel, for six or eight minutes, and then to add the murio-sulphate of tin, alum, and tartar, and to boil them together for about fifteen minutes. A small quantity of this yellow liquor is then to be put into a dyeing vessel which has been previously supplied with water sufficiently heated. The mixture being properly stirred, the dyeing process is to be conducted in the usual way,

and the yellow liquor, as it is wanted, gradually added from the first vessel. In this way the most delicate shades of lively green lemon yellows are dyed with ease and certainty. Weld is the only dyestuff from which similar shades of colour can be obtained; but it is four times more expensive. The yellows dyed from quercitron bark, Dr Bancroft adds, with murio-sulphate of tin and alum as mordants, do not exceed the expense of one penny for each pound of stuff, besides a considerable saving of time, labour, and fuel.²

A greenish shade may also be produced without tartar, by substituting verdigris dissolved in vinegar, along with the bark; but it is neither so permanent, nor so bright and delicate, as that produced by means of tartar. Sulphate of indigo also, in very small proportion, communicates a similar shade when it is employed with the bark, murio-sulphate of tin, and alum; but it is apt to take unequally on the stuff, and besides, in the language of the dyers, the colour has a tendency to *cast* or *fly* in the finishing.

Small proportions of cochineal, employed along with the bark and other ingredients, raise the colour to a beautiful orange, and even to an aurora. Madder may be also employed with the same view, for it heightens the yellow obtained from quercitron bark, although the colour thus obtained is inferior in beauty to that from cochineal. The madder may also be employed with weld for the same purpose.³

The colours obtained from quercitron bark, by the processes which we have now described, are very durable. They resist the action of the air, of soap, and of acids. It is by the effects of alum, but especially of tartar, that these colours become so fixed as to remain permanent by exposure to the air. It is observed of the highest yellows, even when they approach to the orange, and which are best dyed either with muriate or murio-sulphate of tin and bark, that although they resist the action of soap and acids, they are apt to lose their lustre and become brown by the effect of the sun and air; but this also happens to yellows dyed with nitro-muriate of tin, both with the bark and with weld, but in a still greater degree with other yellow vegetable colouring matters. In some of these this defect is less easily obviated by alum and tartar, than it is in the yellow obtained from weld and quercitron bark.⁴

III.—Of the Processes for dyeing Silk Yellow.

To dye silk a plain yellow colour, the only ingredient which was formerly employed was weld. The following is the process. The silk being previously scoured in the proportion of twenty pounds of soap to the hundred of stuff, and then alumed, and washed after the aluming, or, as it is called, *refreshed*, the bath is prepared with two pounds of weld for every pound of silk; and having boiled for fifteen minutes, it is to be passed into a vat through a sieve or cloth. When the temperature is such as the hand can bear, the silk is introduced and turned until it has acquired a uniform colour. While this operation is going on, the weld is to be boiled a second time in fresh water; one half of the first bath is taken out, and its place supplied with a fresh decoction. The temperature of the fresh bath may be a little higher than the former; but it is necessary to guard against too great a degree of heat, that the colouring matter already fixed may not be dissolved. The stuff is to be turned as before, and afterwards taken out of the bath. A quantity of soda is to be dissolved in a part of the second decoction, and a larger or smaller proportion of this solution is to be added to the

Simple
Colours.Verdigris
used for
tartar.Cochineal
and madder
employed.Colours
from quer-
citron bark
very dura-
ble.

With weld.

¹ Bancroft, 330.² Ibid. 333.³ Ibid. 355.⁴ Ibid. 334.

Simple Colours. bath, according to the intensity of the shade required. When the silk has been turned a few times, a skain is wrung out, that it may be examined whether the colour be sufficiently full, and have the proper golden shade. To render the colour deeper, and to give it the gold cast, an addition of the alkaline solution is to be made to the bath, and to be repeated till the shade has acquired sufficient intensity. The alkaline solution may also be added along with the second decoction of the weld, observing the precaution that the temperature of the bath be never too great.

For a deeper colour. To produce other shades of yellow, having more of a gold or jonquille colour, a quantity of anotta, proportioned to the shade required, is to be added to the bath along with the alkali. Lighter shades of yellow, such as pale lemon or Canary bird colour, are obtained by previously whitening the silk, and regulating the proportion of ingredients in the bath by the shade required. To communicate a yellow having a tinge of green, a little indigo is added to the bath, if the silk has not been previously azured. To prevent the intensity of the shade from being too great, the silk may be more slightly alumed than usual.

For other shades. But, according to Dr Bancroft, the different shades of yellow obtained from weld may be given to silk with equal facility and beauty, and at a cheaper rate, by employing quercitron bark as a substitute. A quantity of bark powdered and enclosed in a bag, in proportion to the shade of colour wanted, as from one to two pounds for every twelve pounds of silk, is put into the dyeing vat while the water is cold. Heat is then applied; and when it has become rather more than blood warm, or of the temperature of 100°, the silk, having previously undergone the aluming process, is to be immersed and dyed in the usual way. If a deep shade is wanted, a small quantity of chalk or pearl-ashes may be added towards the end of the operation. To produce a more lively yellow, a small proportion of murio-sulphate of tin may be employed; but it should be cautiously used, as it is apt to diminish the lustre of the silk. To produce such a shade, the proportions of the ingredients may be four pounds of bark, three of alum, and two of murio-sulphate of tin. These are to be boiled with a proper quantity of water for ten or fifteen minutes; and the temperature of the liquid being so much reduced as the hand can bear it, the silk is immersed and dyed as usual, till it has acquired the proper colour. Care should be taken to keep the liquor constantly agitated, that the colouring matter may be equally diffused.¹

A cheaper process. To dye silk of an aurora or orange colour, after being properly scoured, it may be immersed in an alkaline solution of anotta, the strength of which is to be regulated by the shade required; and the temperature of the bath should be between tepid and boiling water. When the desired shade has been obtained, the silks are to be washed and twice beetled, to free them from the superfluous colouring matter, which would injure the beauty of the colour. When raw silk is to be dyed, that which is naturally white should be selected, and the bath should be nearly cold; for otherwise the alkali, by dissolving the gum of the silk, destroys its elasticity. Silk is dyed of an orange shade with anotta; but the stuffs must be reddened with vinegar, alum, or lemon juice. The acid, by saturating the alkali employed to dissolve the anotta, destroys the yellow shade produced by the alkali, and restores its natural colour, which inclines to a red. But although beautiful colours are obtained by this process, they do not possess any great degree of permanency.

Several kinds of mushrooms afford lively and durable yellow dyes. A bright shining dye of this description has been extracted from the *boletus hirsutus*, which commonly grows on walnut and apple trees. The colouring matter is contained both in the tubular part, and also in the parenchyma of the body of the mushroom. To extract the colouring matter, it is pounded in a mortar, and the liquor which is thus obtained is boiled for a quarter of an hour in water. An ounce of liquor is sufficient to communicate colouring matter to six pounds of water. After the liquor has been strained, the stuff to be dyed is immersed in it, and boiled for fifteen minutes. When silk is subjected to this process, after being dyed, it is made to pass through a bath of soft soap, by which it acquires a shining golden yellow colour, which has a near resemblance to the yellow of the silk employed to imitate embroidery in gold. This has been hitherto brought from China, and bears a very high price, the method of dyeing it being unknown in Europe. All kinds of stuff receive this colour; but it is less bright on linen and cotton, and seems to have the strongest affinity for silk. The use of mordants, it is supposed, would modify and improve it greatly.²

IV.—Of the Processes for dyeing Cotton and Linen Yellow.

The process which has been usually followed in dyeing cotton and linen yellow, is by scouring it in a bath prepared in a ley with the ashes of green wood. It is afterwards washed, dried, and alumed, with one fourth of its weight of alum. After twenty-four hours it is taken out of the aluming and dried, but without being washed. The cotton is then dyed in a weld bath, in the proportion of one pound and a quarter of weld for each pound of cotton, and turned in the bath till it has acquired the proper colour. After being taken out of the bath, it is soaked for an hour and a half in a solution of blue vitriol (sulphate of copper), in the proportion of one fourth of the weight of the cotton, and then immersed, without washing, for nearly an hour in a boiling solution of white soap, after which it is well washed and dried.

A deeper yellow is communicated to cotton by omitting the process of aluming, and employing two pounds and a half of weld for each pound of cotton. To this is added a dram of verdigris, mixed with part of the bath. The cotton is then to be dipped and worked till the colour become uniform. It is then taken out of the bath, that a little solution of soda may be added, after which it is returned and kept for fifteen minutes. It is then wrung out and dried.

Other shades of yellow may be obtained by varying the proportion of ingredients. Thus a lemon colour is dyed by using only one pound of weld for every pound of cotton, and by diminishing the proportion of verdigris, or using alum as a substitute.³

But a better method, as it affords more permanent and more beautiful colours, and at a smaller expense, is recommended by Dr Bancroft. This is by the use of quercitron bark, and the calico-printers' aluminous mordant, or the sugar of lead. The following is the process which he proposes to employ for producing bright and durable yellow colours. One pound of sugar of lead and three pounds of alum are to be dissolved in a sufficient quantity of warm water. The cotton or linen, after being properly rinsed, is to be soaked in this mixture, heated to the temperature of 100°, for two hours. It is then taken out, moderately pressed over a vessel, to prevent the waste of the aluminous liquor. It is then dried in a stove heat, and after being again soaked in the aluminous solution, it is wrung

Simple Colours. Yellow dye from mushrooms.

Processes with weld.

For a deeper yellow.

Other shades.

Cheaper and more permanent colours.

¹ Bancroft, 345.

² Philosophical Magazine, vol. 100.

³ Berthollet, ii. 267.

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Colours.

out and dried a second time. Without being rinsed, it is to be barely wetted with lime water, and afterwards dried; and if a full, bright, and durable yellow is wanted, it may be necessary to soak the stuff in the diluted aluminous mordant, and, after drying, to wet it a second time with lime water. After it has been soaked for the last time, it should be well rinsed in clean water, to separate the loose particles of the mordant, which might injure the application of the colouring matter. By the use of the lime-water, a greater proportion of alumina combines with the stuff, besides the addition of a certain proportion of lime.

Dyeing
bath.

In the preparation of the dyeing bath, from twelve to eighteen pounds of powdered quercitron bark are inclosed in a bag for every hundred pounds of the stuff, varying the proportion according to the intensity of the shade desired. The bark is put into the water while it is cold; and immediately after, the stuff is immersed and agitated or turned for an hour or an hour and a half, during which the water should be gradually heated, and the temperature raised to about 120°. At the end of this time the heat is increased, and the dyeing liquor brought to a boiling temperature; but at this temperature the stuff must remain in it only for a few minutes, because otherwise the yellow assumes a brownish shade. The stuff having thus acquired a sufficient colour, is taken out, rinsed, and dried.

Advantage
of a diluted
mordant.

Dr Bancroft observes, that when the aluminous mordant is employed without the addition of water, one soaking only, and an immersion in lime water, may be sufficient; but he thinks that greater advantage is derived from the application of a more diluted mordant at two different times, or even by the immersion of the stuff a greater number of times, alternately in the diluted aluminous mordant, and lime water, and drying it after each immersion. By this treatment he found that the colour always acquired more body and durability.

Nankeen
yellow.

Chaptal has proposed a process for communicating to cotton a nankeen yellow, which, at the same time that it affords a durable colour, has the advantage of being cheap and simple. When cotton is immersed in a solution of any salt of iron, it has so strong an affinity for the oxide, that it decomposes the salt, combines with the iron, and assumes a yellow colour. The process recommended by Chaptal is the following: The cotton to be dyed is put into a cold solution of copperas (sulphate of iron), of the specific gravity 1.02. It is afterwards wrung out, and immediately immersed in a ley of potash of the specific gravity 1.01. This ley must have been previously saturated with a solution of alum. When the stuff has been kept for four or five hours in this bath, it may be taken out, washed, and dried. By varying the proportion of sulphate of iron, every variety of shade of nankeen yellow may be obtained.

By another
process.

We shall lay before our readers another process for dyeing nankeen colour, which is proposed and followed by Mr Brewer, a practical dyer. It is as follows:—

“Mix as much sheep’s dung in clear water as will make it appear of the colour of grass; and dissolve in clear water one pound of best white soap for every ten pounds of cotton yarn, or in that proportion for a greater or lesser quantity.

“Observe:—The tubs, boards, and poles, that are used in the following preparations must be made of deal; the boiling pan of either iron or copper.

First operation.—“Pour the soap liquor prepared as above into the boiling pan; strain the dung liquor through a sieve; add as much thereof to the soap liquor in the pan as will be sufficient to boil the yarn intended to be dyed,

for five hours. When the liquors are well mixed in the pan, enter the yarn, light the fire under the pan, and bring the liquor to boil in about two hours, observing to increase the heat regularly during that period. Continue it boiling for three hours; then take the yarn out of the pan, wash it, wring it, and hang it in a shed on poles to dry. When dry, take it into a stove or other room where there is a fire; let it hang there until it be thoroughly dry.

N. B.—“The cotton yarn, when in the shed, should not be exposed either to the rain or sun. If it is, it will be unequally coloured when dyed.

Second operation.—“In this operation use only one half of the soap that was used in the last, and as much dung liquor (strained as before directed) as will be sufficient to cover the cotton yarn, when in the pan, about two inches. When these liquors are well mixed in the pan, enter the yarn, light the fire, and bring the liquor to boil in about one hour; then take the yarn out, wring it out without washing, and hang it to dry, as in the former operation.

Third operation.—“This operation the same as the second in every respect.

Fourth operation.—“For every ten pounds of yarn make a clear ley from half a pound of pot or pearl ashes. Pour the ley into the boiling pan, and add as much clear water as will be sufficient to boil the yarn for two hours; then enter the yarn, light the fire, and bring it to boil in about an hour. Continue it boiling about an hour, then take the yarn out, wash it very well in clear water, wring it, and hang it to dry, as in former operations.

N. B.—“This operation is to cleanse the yarn from any oleaginous matter that may remain in it after boiling in the soap and dung liquors.

Fifth operation.—“To every gallon of iron liquor¹ add half a pound of ruddle or red chalk (the last the best) well pulverized.

“Mix them well together, and let the liquor stand four hours, in order that the heavy particles may subside; then pour the clear liquor into the boiling-pan, and bring it to such a degree of heat as a person can well bear his hand in; divide the yarn into small parcels, about five hanks in each; soak each parcel or handful very well in the above liquor, wring it, and lay it down on a clean deal board. When all the yarn is handed through the liquor, the last handful must be taken up and soaked in the liquor a second time, and every other handful in succession, till the whole is gone through; then lay the yarn down in a tub, wherein there must be put a sufficient quantity of ley, made from pot or pearl ashes, as will cover it about six inches. Let it lie in this state about two hours, then hand it over in the ley, wring it, and lay it down on a clean board. If it does not appear sufficiently deep in colour, this operation must be repeated till it has acquired a sufficient degree of darkness of colour. This done, it must be hung to dry, as in former operations.

N. B.—“Any degree of red or yellow hue may be given to the yarn, by increasing or diminishing the quantity of ruddle or red chalk.

Sixth operation.—“For every ten pounds of yarn make a ley from half a pound of pot or pearl ashes; pour the clear ley into the boiling pan; add a sufficient quantity of water thereto, that will cover the yarn about four inches; light the fire, and enter the yarn when the liquor is a little warm; observe to keep it constantly under the liquor for two hours; increase the heat regularly till it come to a scald; then take the yarn out, wash it, and hang it to dry, as in former operations.

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Colours.

¹ Iron liquor is what the linen-printers use.

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Seventh operation.—"Make a sour liquor of oil of vitriol and water. The degree of acidity may be a little less than the juice of lemons; lay the yarn in it for about an hour, then take it out, wash it very well, and wring it; give it a second washing and wringing, and lay it upon a board.

N. B.—"This operation is to dissolve the metallic particles, and remove the ferruginous matter that remains on the surface of the thread after the fifth operation.

Eighth operation.—"For every ten pounds of yarn dissolve one pound of best white soap in clear water, and add as much water to this liquor in your boiling-pan as will be sufficient to boil the yarn for two hours. When these liquors are well mixed, light the fire, enter the yarn, and bring the liquor to boil in about an hour. Continue it boiling slowly an hour; take it out, wash it in clear water very well, and hang it to dry, as in former operations. When dry, it is ready for the weaver.

N. B.—"It appears to me, from experiments that I have made, that less than four operations in the preparation of the yarn will not be sufficient to cleanse the pores of the fibres of the cotton, and render the colour permanent."¹

Process
followed in
the East.

A method of giving a very fixed yellow to cotton and linen is practised in the East. It is precisely similar to the plan followed in dyeing Turkey red. The cloth is first impregnated with the oleaginous soap. It is then passed through a decoction of nutgalls, or of some substance containing tannin. The aluminous mordant is then applied. After all these preliminary steps have been accomplished, the cloth is dyed in the usual way with quercitron bark. These complicated processes being precisely similar to those followed by the Turkey-red dyers, we refer the reader for particulars to the fourth division of the first section of the present chapter.

Such processes, however, are unnecessary in this country, because as permanent and beautiful a colour can be given at once to cotton by impregnating it with acetate or nitrate of lead, and then passing the cloth through a solution of bichromate of potash.

SECT. III.—Of Blue.

We shall follow the same method in giving an account of the blue dye, as we did when giving an account of the red and yellow dyes; that is to say, we shall first notice the dyestuffs, and then describe the processes followed by the dyers.

I.—Description of the Dyestuffs.

The only dyestuff used for giving a blue colour to cloth is *indigo*, a blue pigment obtained from various species of plants. The most common plant yielding indigo is the *Indigofera*, of which there are three species, the *tinctoria*, the *disperma*, and the *argentea*. The *nerium tinctorium*, or rose bay, a tree which is a native of India, also yields it. The method of procuring indigo from these plants, the nature and properties of indigo, and its composition, have been detailed in the article CHEMISTRY in this Encyclopædia, to which therefore we refer the reader.

Constitu-
ents of in-
digo.

Mr Crum has shown that the atomic constituents of indigo are,

16 atoms carbon.....	12
4 atoms hydrogen.....	0.5
1 atom azote.....	1.75
2 atoms oxygen.....	2
	16.25

Indigo in its perfect state is insoluble in water and alcohol, and has not the property of combining with bases. But when deprived of one atom of oxygen, it assumes a yellow colour, and in that state is capable of combining with lime or potash, and doubtless with other bases, and of forming with them compounds which dissolve in water. When cloth to be dyed is dipped into the indigo vat, rendered soluble by being deprived of an atom of oxygen, and united to a base, it comes out stained yellow. But the basis of the indigo begins immediately to attract oxygen from the atmosphere, and to resume its blue colour. This causes the cloth speedily to become green by the mixture of yellow and blue, and finally to assume a deep-blue colour. No mordant is necessary, as there is a strong affinity between indigo and the fibres of the cloth.

When indigo is digested in concentrated sulphuric acid Cerulin. it undergoes a remarkable change, being converted into a peculiar blue substance, with which the Saxon blue is dyed. To this substance Mr Crum, to whom we are indebted for the first accurate examination of it, has given the name of *cerulin*. Mr Crum has shown that it is a compound of one integrant particle of indigo, and four integrant particles of water.

The mixture of cerulin with sulphuric acid is semifluid, which requires a considerable quantity of water to dissolve it. When potash is added to this solution, a deep-blue precipitate falls, which is a compound of sulphate of potash and cerulin. To this compound Mr Crum has given the name of *cerulio-sulphate of potash*. All the neutral salts have the property of combining with cerulin, and of precipitating it from its aqueous solution.

Mr Crum discovered that if the action of sulphuric Phenicin. acid on indigo be stopped at a certain point, a new substance is formed, different from cerulin. To this new substance he gave the name of *phenicin*. It may be obtained by the following process: Digest indigo in sulphuric acid diluted with thrice its weight of water. By this process the indigo is deprived of the greater part of its impurities. Mix one part of this purified indigo with seven or eight parts of concentrated sulphuric acid in a stoppered phial, and agitate the mixture occasionally till it becomes of a bottle-green colour. Then mix it with a large quantity of distilled water, and throw it upon a filter. By continuing to wash the filter, the liquid, which at first passes through colourless, becomes more and more blue, and after some time all the indigo which has been changed passes through. The colourless washings must be thrown away. The blue liquid contains the phenicin in solution, which on the addition of chloride of potassium precipitates of a most beautiful reddish-purple colour, exactly similar to the colour of the vapour of indigo. Its solution is of a fine blue colour like cerulin, but when a neutral salt is added it is precipitated of a fine purple colour. Hence the origin of the term *phenicin*.² Mr Crum has shown that it is a compound of one integrant particle of indigo and two integrant particles of water.

Indigo is not confined to plants growing within the torrid zone. The *isatis tinctoria* and *isatis lusitanica*, plants which are cultivated in England and France, yield, when treated in the same way with the leaves of the *indigofera*, a little indigo; but the quantity is too small to make it worth while to employ these plants for the preparation of this valuable dyestuff. But those plants under the names of *pastel* or *woad* were formerly employed for dyeing blue in all parts of Europe; and it was to prevent any supposed injury to the cultivators of woad that the em-

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¹ Edinburgh Magazine, xxii.

² From *φενίξ*, purple.

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ployment of indigo in dyeing was prohibited in Queen Elizabeth's time in England. The limitations of the use of indigo in France and Saxony were owing to the same cause. So little at that time were the first principles of political economy understood by the rulers of the different kingdoms of Europe.

Woad is still used by the dyers in some of their processes, but merely for the purpose of de-oxidizing indigo, and thus rendering it soluble in water.

II.—Methods of dyeing Wool Blue.

Preparation of the vat.

The preparation for dyeing blue is made in a large wooden vessel or vat, which should be so constructed as to retain the heat, which is a matter of considerable importance in the process. The vat is therefore set up in a separate place from the coppers, and is sunk so far in the ground as to be only breast-high above it. Before the introduction of indigo, blue was dyed with woad, which furnished a permanent but not a deep colour; but a very rich blue is obtained by mixing indigo with the woad, and these are almost the only substances which are now employed for dyeing woollen stuffs. The proportions of these substances are varied by different dyers, and according to the shade which is required. The following is the account of the preparation of a vat, as it is given by Quatremere. Into a vat of about seven and a half feet deep, and five and a half in diameter, are thrown two balls of pastel or woad, which are previously broken, and together amount to about 400 pounds weight; thirty pounds of weld are boiled in a copper for three hours in a sufficient quantity of water to fill the vat. To this decoction are added twenty pounds of madder and a basket full of bran. The boiling is then continued half an hour longer. This bath is cooled with twenty buckets of water, and after it is settled, and the weld taken out, it is poured into the vat, which must be stirred with a rake all the time that it is running in, and for fifteen minutes longer. The vat is then covered up very hot, and allowed to stand for six hours, when it is uncovered, and raked again for thirty minutes. The same operation must be repeated every three hours. When the appearance of blue streaks is perceived on the surface of the vat, eight or nine pounds of quicklime are added; the colour then becomes of a deeper blue, and the vat exhales more pungent vapours. Immediately after the lime, or along with it, the indigo, which has been previously ground in a mill, with the smallest possible quantity of water, is put into the vat. The quantity is to be regulated by the intensity of the shade required. From ten to thirty pounds may be put into a vat such as we have now described. If on striking the vat with a rake a fine blue scum arises, no other previous preparation is required than to stir it with the rake twice in the space of six hours, to mix the ingredients completely. Great care should be taken not to expose the vat to the air, except during the time of stirring it. When that operation is finished, it is covered with a wooden lid, on which are spread thick cloths, to retain the heat as much as possible; but after all these precautions, at the end of eight or ten days it is greatly diminished, and is at last entirely dissipated, so that the liquor must be again heated, by pouring the greater part of the liquor of the vat into a copper under which a large fire is made. When the liquor has acquired a sufficient temperature, it is returned into the vat, and carefully covered up.

Accidents to which the vat is liable.

Vats of this description are sometimes liable to accidents. A vat is said to be repelled when, having previously afforded fine shades of blue, it appears black, without any blue streaks; and if it be stirred, the black colour becomes deeper; the vat at the same time exhales, instead of a sweetish smell, a pungent odour; and the stuff dyed in a

vat in this state comes out of a dirty gray colour. These effects are ascribed to an excess of lime.

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Means of obviating them.

Different means are employed to recover a repelled vat. Some are satisfied with merely reheating it, while others add tartar, bran, urine, or madder. Hellot recommends bran and madder as the best remedy. If the excess of lime be not very great, it is sufficient to leave it at rest five or six hours, putting in a quantity of bran and three or four pounds of madder, which are to be sprinkled on the surface, and then it is to be covered up, and after a certain interval to be tried again. But if the vat has been so far repelled as to afford a blue only when it is cold, it must be left at rest to recover, and sometimes must remain whole days without being stirred with the rake. When it begins to afford a tolerable pattern, the bath must be reheated. In general this revives the fermentation. The addition of bran or madder, or a basket or two of fresh woad, produces the same effect.

This vat sometimes runs into the putrefactive process, and remedies. When this happens, the colour of the vat becomes reddish, the paste rises from the bottom, and a fetid smell is exhaled. This accident is owing to a deficiency of lime, and it must be corrected by adding a fresh quantity. The vat is then to be raked; after two hours more lime is added, and the process of raking again performed. These operations are to be repeated till the vat is recovered.

Precautions in the use of lime.

Nothing requires more attention in treating a vat of this kind than the distribution of the lime, the principal use of which is to moderate the tendency to putrefaction, and to limit the fermentation to that degree which is necessary to deprive the indigo of its oxygen. If too much lime be added, the necessary fermentation is retarded; and if there be too little, the putrefactive process commences.

Two hours previous to the dyeing operation, the vat should be raked; and to prevent the stuff coming in contact with the sediment, which would produce inequalities in the colour, a cross of wood is introduced. The stuff is then to be completely wetted with pure water a little heated, and being wrung out, it is dipped into the vat, where it is moved about for a longer or a shorter time, according to the depth of shade required. During this operation, it is taken out occasionally to be exposed to the air, the action of which is necessary to change the green colour of the bath into a blue. Stuffs dyed blue in this manner must be carefully washed, to carry off the loose particles of colouring matter; and when the shade of blue is deep, they ought even to be cleansed by fulling with soap. This operation does not alter the colour.

What happens in vats of this kind is the separation of an atom of oxygen from the indigo by the action of the fermenting woad. The base of the indigo thus evolved unites to the quicklime, and this compound dissolving in the water, forms the dyestuff. The reason why the air must be so cautiously excluded is, that, by reviving the indigo, it precipitates it from the liquid, and thus deprives the vat of its colouring matter.

Instead of woad, and the other ingredients just mentioned, indigo is deprived of an atom of oxygen, and the base of it dissolved in water by a mixture of bran and potash. Orpiment is also occasionally employed, which has the property of absorbing an atom of oxygen from indigo, and rendering it capable of combining with a base, and of dissolving in water.

The indigo vat employed by the calico-printers is formed by mixing the indigo with the requisite quantity of sulphate of iron to reduce it to its base, and of quicklime to combine with the base evolved, and to cause it to dissolve in water. Such vats are made very deep. The surface, in consequence of exposure to the air, has a blue colour, the indigo being revived. But the liquor, at a little dis-

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tance from the surface, has a yellow colour. This indeed is the case with all indigo vats. The green colour which they exhibit near the surface is merely the consequence of the mixture of revived indigo with the yellow coloured liquid.

Discovery of Saxon blue.

The colour which is obtained by dyeing with a solution of indigo in sulphuric acid is known under the name of *Saxon blue*, because the process was first carried on at Grossenhayn, in Saxony, by Counsellor Barth, who made the discovery about the year 1740. This discovery was for some time kept secret, and the method seems to have been originally very complicated. Alumina, antimony, and some other substances, were previously added to the sulphuric acid. These, however, are now omitted, and the indigo alone is dissolved in the acid.

For woollen stuffs.

To produce a Saxon blue colour on woollen stuffs, they are prepared with alum and tartar; and in proportion to the shade required, the quantity of solution of indigo put into the bath must be regulated. When a deep shade of Saxon blue is wanted, the stuff must be passed different times through vessels containing such a quantity of colouring matter as is sufficient to give light colours. In this way, by repeated applications, the colours become more uniform.

We are not aware that Prussian blue is employed as a dyeing material for wool; but it is used to a considerable extent in calico-printing, and has an exceedingly good effect when skilfully used. We shall notice its employment in a subsequent part of this article.

III.—Processes for dyeing Silk Blue.

With indigo.

Silk is dyed blue with indigo alone, without any proportion of woad. The proportion of indigo mentioned in the preparation of the indigo vat, and sometimes a larger proportion, is employed, with six pounds of bran and about twelve ounces of madder. According to Macquer, half a pound of madder for each pound of potash renders the vat greener, and produces a more fixed colour in the silk. When the vat is come to, it should be refreshed with two pounds of potash and three or four ounces of madder, and, after being raked, in the course of four hours it is fit for dyeing. The temperature should be so moderated that the hand may be held in it without uneasiness.

Preparation of the silk.

The silk, after being boiled with soap, in the proportion of thirty pounds of soap to a hundred of silk, and well cleaned by repeated beetlings in a stream of water, must be dyed in small portions, because it is apt to take on an uneven colour. When it has been turned once or oftener in the bath, it is wrung out and exposed to the air, that the green colour may change to a blue. When the change is complete, it is thrown into clear water, and afterwards wrung out. Silk dyed blue should be speedily dried. In damp weather and in winter it is necessary to conduct the drying in a chamber heated by a stove. The silk should be hung on a frame kept constantly in motion. To dye light shades, some dyers employ vats that are somewhat exhausted; but it ought to be observed that the colour thus obtained is less beautiful and less permanent than when fresh vats, containing a smaller quantity of indigo, are employed.

For Turkey blue.

Some addition is required to be made to the indigo, to give silk a deep blue. A previous preparation is necessary, by giving it another colour or ground. For the Turkey blue, which is the deepest, a strong bath of archil is first prepared. Cochineal is also sometimes used instead of archil, for the ground, to render the colour more permanent. A blue is given to silk by means of verdigris and logwood, but it possesses little durability. It might be rendered more permanent by giving it a lighter shade in

this bath, then dipping it in a bath of archil, and finally in the indigo vat.

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Dyeing raw silk.

When raw silk is to be dyed blue, such as is naturally white should be selected. Being previously soaked in water, it is put into the bath in separate hanks, as already directed for scoured silks; and as raw silk is found to combine more readily with the colouring matter, the scoured silk, when it can be conveniently done, should be first put into the bath. If archil, or any of the other ingredients which have been already mentioned, are required to give more intensity to the colour, the mode of application is the same as that directed for scoured silk.

IV.—Processes for dyeing Cotton and Linen Blue.

For dyeing cotton and linen blue, Pileur d'Apligny recommends a vat containing about 120 gallons. From six to eight pounds of indigo, reduced to powder, are boiled in a ley drawn off from a quantity of lime equal in weight to the indigo, and a quantity of potash double its weight. During the boiling, which is to be continued till the indigo is completely penetrated with the ley, the solution must be constantly stirred, to prevent the indigo from being injured by adhering to the bottom of the vessel.

During this process another quantity of quicklime, equal in weight to the indigo, is to be slaked. Twenty quarts of warm water are added, in which is to be dissolved a quantity of sulphate of iron equal to twice the weight of the lime. The solution being completed, it is poured into the vat, which is previously half filled with water. To this the solution of indigo is added, with that part of the ley which was not employed in the boiling. The vat must now be filled up to within two or three inches of the top. It must be raked twice or thrice a day till it is completely prepared, which is generally the case in forty-eight hours, and sometimes sooner, as it depends on the temperature of the atmosphere. A small proportion of bran, madder, and woad, is recommended by some to be added to such a vat as we have now described.

The process which is followed at Rouen, and described by Quatremere, is simpler. The vats, which are constructed of a kind of flint, are coated within and without with fine cement, and are arranged in one or more parallel lines. Each vat contains four hogsheads of water. The indigo, to the amount of eighteen or twenty pounds, being macerated for a week in a caustic ley strong enough to bear an egg, is ground in a mill; three hogsheads and a half of water are put into the vat, and afterwards twenty pounds of lime. The lime being thoroughly slaked, the vat is raked, and thirty-six pounds of copperas are added; and when the solution is complete, the ground indigo is poured in through a sieve. It is raked seven or eight times the same day, and after being left at rest for thirty-six hours, it is in a state fit for dyeing.

In extensive manufactories it is necessary to have vats set at different times. In conducting the process of dyeing, the stuffs are first dipped in the most exhausted vat, and then regularly proceeding from the weakest to the strongest, if they have not previously attained the desired shade. The stuffs should remain in the bath only about five or six minutes, for in that time they combine with all the colouring matter they can take up. After the stuffs have been dipped in a vat, it should not be used again till it has been raked, and has stood at least twenty-four hours, unless it has been lately set, when a shorter period is sufficient.

After the stuffs have been dipped three or four times in a vat, it begins to change. It becomes black, and no blue or copper-coloured streaks are seen on the surface after raking it. It must then be renewed by adding four pounds of copperas with two of quicklime, after which it

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must be raked twice. In this way a vat may be renewed three or four times; but the additional quantity of ingredients must be diminished as the strength of the vat is exhausted.¹

Process of
Bergman.

A vat which is still more simple and more easily prepared has been recommended by Bergman. The proportion of the ingredients which he has directed to be employed is the following. To three drachms of indigo reduced to powder, three drachms of copperas, and three of lime, add two pints of water. Let it be well raked, and in the course of a few hours it will be in a proper state for dyeing.

Hauss-
mann's.

Haussmann employs a still smaller proportion of indigo. For 3000 lbs. of water he takes thirty-six lbs. of quicklime slaked in 200 lbs. of water, with which the indigo in the proportion of from ten to twenty lbs. well ground is to be mixed. He then dissolves thirty lbs. of copperas in 120 lbs. of hot water. The whole being left at rest for fifteen minutes, the vat is filled, and gently and constantly stirred. When a deeper shade is wanted, and particularly when linen is to be dyed, the proportion of indigo should be greater; but the shade depends very much on the time the stuffs remain in the vat, and the times it has been used. When the vat becomes turbid, the process of dyeing must be interrupted till it has been again raked, and the supernatant liquor become transparent. If the effects of the lime fail, a new quantity, fresh slaked, must be added; and if the iron cease to produce the effect on the indigo, a new portion must be also added, observing the precaution to have a greater quantity of lime than what is necessary to saturate the sulphuric acid. When the indigo seems to be exhausted, fresh portions ground in water are also to be added; the vat is to be raked several times, and allowed to settle, after which it is again fit for use. In this way Mr Haussmann informs us he preserved a vat for the space of two years; and had it not been for the accumulation of sediment, which prevented the stuffs from being immersed to a sufficient depth, it might have been continued in use for a much longer time. It is worth while to add, that Mr Haussmann found that a pattern of cloth dipped in water acidulated with sulphuric acid, immediately after it was taken out of the bath, became of a much deeper blue than a similar pattern exposed to the air, or another dipped in river water.

Another convenient and expeditious vat is mentioned by Bergman and described by Scheffer. Indigo reduced to fine powder, in the proportion of three drachms to a quart, is added to the strong ley of the soap boiler. After a few minutes, when the colouring matter is well penetrated by the ley, six drachms of coloured orpiment are to be added. In a few minutes after the bath has been well raked it becomes green, and the blue streaks appear on the surface. Heat is to be applied, when the operation of dyeing may commence.

The preparation employed for printing cottons is similar to the above bath, excepting in the proportions of orpiment and indigo, which are greater in the former; but these proportions are very different in different manufactories.

English
blue.

The colour denominated *English blue* is produced by the solution of indigo in sulphuric acid, to which Bancroft gave the improper name of *sulphate of indigo*. To give

silk this colour, it is first to be dyed a light blue; and, when taken out of this bath, it is dipped in hot water, washed in a stream, and left in a bath composed of the sulphate of indigo, to which a little of the solution of tin has been added, until the proper shade is obtained, or the bath is exhausted. Previous to its being put into this bath, it may be dipped in a solution of alum, in which it should remain only a very short time. Silk which has been dyed according to this process is free from the reddish shade which it derives from the blue vat, as well as from the greenish cast of the Saxon blue.²

The sulphate of indigo has been hitherto only applied for the purpose of dyeing wool and silk. The affinity of indigo for vegetable substances is not sufficiently strong to effect the decomposition of the sulphate. It cannot, therefore, be employed with advantage in dyeing cotton and linen.

SECT. IV.—Of Black.

Though black, considered optically, is not a colour, but the absence of the power of reflecting light, it constitutes a very important colour in the estimation of the dyer.

I.—Description of the Dyestuffs.

There are few substances which have the property of producing a permanent black colour without any addition. The juice of some plants produces this effect on cotton and linen. A black colour is obtained from the juice of the *cashew nut*, which will not wash out, and even resists the process of boiling with soap or alkalies. The cashew nut of India is employed for marking linen. That of the West Indies (*anacardium occidentale*, Lin.) also yields a permanent dye, but the colour has a brownish shade. The juice of some other plants, as that of the *toxicodendron*, or *sloes*, affords a durable bluish black colour; but these substances cannot be obtained in sufficient quantity, even if they afforded colours equal to those produced by the common processes.

The principal substances which are employed to give a black colour are gallnuts, which contain the astringent principle or tan, and the red oxide of iron.³ These have been described either in a preceding part of this article, or under the article CHEMISTRY, to which therefore we refer the reader. The black colour is produced by the combination of the astringent principle with the oxide of iron, held in solution by an acid, and fixed on the stuff. When the particles are precipitated from the mixture of tan and a solution of iron, they have only a blue colour; but after they are exposed for some time to the air, and moistened with water, the colour becomes deeper, although the blue shade is still perceptible. After the particles are fixed on the stuff, the shade becomes much deeper.

Logwood is not to be considered as affording a black dye, but is much employed to give a lustre to black colours. We have already described its nature and properties among the substances from which red colouring matters are obtained.

Black colours are rarely produced by a simple combination between the colouring matter and the stuff, but are usually fixed by means of mordants, as in the case of the black particles which are the result of a combination of

¹ Berthollet, ii. 90.

² Oak bark has been recommended as a substitute for gallnuts in dyeing black, and particularly in dyeing hats; and it is said that the colour thus obtained is fuller, more beautiful and durable, while the operation is easier, and less liable to accident. It was first proposed in the year 1782, by Stephanopoli, a Corsican, and a surgeon in the French army. The examination of the process was referred by the French government to Macquer, who gave a favourable report of it; and afterwards to Berthollet, who gave a different opinion. The process has since been examined, and promises to be more economical and advantageous, especially for dyeing hats. (*Phil. Mag.* vi. 176.)

³ *Ibid.* ii. 319.

Simple
Colours.

Simple Colours.

the astringent principle and the oxide of iron, held in solution by an acid. But when the particles are precipitated from the mixture of an astringent and a solution of iron, they have only a blue colour. By being exposed to the air, and moistened with water, the colour becomes deeper, although the blue shade is still perceptible. No fine black colour is ever obtained, unless the stuffs are freely exposed to the air. In dyeing black, therefore, the operations must be conducted at different intervals. Berthollet has observed that black stuffs, when brought in contact with oxygen gas, diminish its volume, so that some portion of it is absorbed.

II.—Of the Processes for dyeing Woollen Black.

Must be first dyed blue.

In dyeing woollen stuffs black, if a full and fine deep colour is wanted, it is necessary that they be previously dyed of a deep blue colour. To remove all the particles of colouring matter which happen to be loosely attached to the stuff, it should be washed in a river as soon as it is taken out of the vat, and afterwards cleansed at the fulling mill. After these preliminary processes, the stuffs are ready to receive the black colouring matter. The process of Hellot is the following.

Hellot's process.

For every hundred pounds of stuff, ten pounds of logwood, and ten pounds of galls reduced to powder, are put into a bag, and boiled in a middle-sized copper, with a sufficient quantity of water, for twelve hours. A third of this bath is put into another copper, along with two pounds of verdigris. The stuff is immersed in this bath, and continually stirred for two hours. The bath should be kept hot, but it ought not to boil. At the end of two hours the stuff is taken out, and a similar portion of the bath is put into the copper, with eight pounds of copperas (sulphate of iron). During the solution of the copperas the fire is diminished, and the bath is allowed to cool for half an hour, stirring it well the whole time. The remainder of the bath is then to be added, and after making this addition, the bag containing the astringent matters should be strongly pressed, to separate the whole. A quantity of sumach, from fifteen to twenty pounds, is now to be added, and the bath is just raised to the boiling temperature; and when it has given one boil it is to be immediately stopped with a little cold water. A fresh quantity of sulphate of iron, to the amount of two pounds, is then added, and the stuff is kept in it for another hour, after which it is taken out, washed, and aired; it is again put into the copper, and constantly stirred for an hour. It is then carried to the river, well washed, and fullled. To soften the black colour, and make it more firm, another bath is prepared with weld. This is made to boil for a moment, and when it has cooled, the stuff is passed through it. By this process, which is indeed somewhat complicated, a beautiful black colour is produced.

Common process.

But the processes usually followed for dyeing black are more simple. Cloth which has been previously dyed blue is merely boiled in a vat of galls for two hours. It is then kept two hours, but without boiling, in the bath of logwood and sulphate of iron, and afterwards washed and fullled. According to Hellot's process, a bath is to be prepared of a pound and a half of yellow wood, five pounds of logwood, and ten pounds of sumach, which is the proportion of the ingredients for every fifteen yards of deep blue cloth; and the cloth having boiled in this bath for three hours, ten pounds of sulphate of iron are added; the cloth is allowed to remain for two hours longer, when it is taken out to be aired, after which it is again returned to the bath for an hour, and then washed and fullled.

A cheaper process.

When stuffs are to be dyed at a less expense, instead of the blue ground, a brown or root-coloured ground may

be substituted. This brown or fawn colour is communicated by means of the root of the walnut tree, or green walnut peels. The stuffs are then to be dyed black, according to some of the processes already described.

Simple Colours.

The proportions of the ingredients employed by the English dyers are, for every hundred pounds of cloth previously dyed a deep blue, about five pounds of sulphate of iron, five pounds of galls, and thirty of logwood. The first step in the process is to gall the cloth, after which it is passed through the decoction of logwood, to which the sulphate of iron has been added.

Process of the English dyers.

The leaves of the *arbutus uva ursi* have been recommended and employed as a substitute for galls. The leaves must be carefully dried, so that the green colour may be preserved. A hundred pounds of wool are boiled with sixteen pounds of sulphate of iron and eight of tartar for two hours. The day following the cloth is to be rinsed, as after aluming. A hundred and fifty pounds of the leaves of *uva ursi* are then to be boiled for two hours in water, and after being taken out, a small quantity of madder is to be added to the liquor, putting in the cloth at the same time, which is to remain about an hour and a half. It is then taken out and rinsed in water.¹ By this process, it is said, blue cloth receives a pretty good black, but white cloth becomes only of a deep brown. It is said, too, that the madder and tartar are useless ingredients.

Arbutus used for galls.

After the different operations for dyeing the cloth have been finished, it is washed in a river, and fullled, till the water comes off clear and colourless. Soap suds are recommended by some in fulling fine cloths, but it is found difficult to free the cloth entirely from the soap. After the cloth has come from the fulling-mill, some propose to give it a dip in a bath of weld, by which it is said to be softened, and the colour better fixed; but, according to Lewis, this operation, which in other cases is of some advantage, is useless after the cloth has been treated with the soap suds.

Last operation.

III.—Of the Processes for dyeing Silk Black.

In communicating a black colour to silk, different operations are necessary, such as boiling, galling, repairing the bath, dyeing, and softening.

To give a deeper shade to silk, it is necessary to deprive it of the gummy substance to which its stiffness and elasticity are owing. This is done by boiling the silk four or five hours with one fifth its weight of white soap, and afterwards beetling and carefully washing it.

In conducting the process of galling silk, three fourths of its weight of galls are to be boiled for three or four hours; but the proportion of galls must depend on their quality. After the boiling, the liquor is allowed to remain at rest for two hours; the silk is then put into the bath, and left there from twelve to thirty-six hours, when it is to be taken out, and washed in the river. But as silk is capable of combining with a great proportion of the astringent principle, or tan, from which it receives a considerable increase of weight, it is allowed to remain for a longer or shorter time, as the silk is required to have more or less additional weight. To communicate, therefore, to silk, what is called a *heavy* black, it is allowed to remain longer in the gall liquor: the process is repeated oftener, and the silk is also dipped in the dye a greater number of times.

Galling.

While silk is preparing for the process of dyeing, the bath is to be heated, and should be occasionally stirred, that the grounds which fall to the bottom may not acquire too much heat. It should always be kept under the boiling temperature. Gum and solution of iron are added in different proportions, according to the different processes.

Dyeing.

¹ Stockholm Trans. 1753.

Simple
Colours.

When the gum is dissolved, and the bath near the boiling temperature, it is left to settle for about an hour. The silk, which in general is previously divided into three parts, that each may be successively put into the bath, is immersed in it. Each part is then to be three times wrung, and after each wringing hung up to air. The silk being thus exposed to the action of the air, acquires a deeper shade. This operation being finished, the bath is again heated, with the addition of gum and sulphate of iron; and this is repeated two or three times, according as the black required is light or heavy. When the process of dyeing is finished, the silk is rinsed in a vessel with some cold water, by turning or shaking it over.

Softening.

Silk, after it has been taken out of the dye, is extremely harsh, to remove which it is subjected to the operation of softening. A solution of four or five pounds of soap for every hundred pounds of silk is poured through a cloth into a vessel of water. The solution being completed, the silk is immersed, and allowed to remain in it for about fifteen minutes; it is then to be wrung out and dried.

Dyeing
raw silk.

When raw silk is to be dyed, that which has a natural yellow colour is preferred. The galling operation must be performed in the cold, if it be proposed to preserve the whole of the gum, and the elasticity which it gives to the silk; but if part only of the gum is wished to be preserved, the galling is to be performed in the warm bath.

The dyeing operation is also performed in the cold. All that is necessary is to add the sulphate of iron to the water in which the stuff is rinsed. By this simple process the black dye is communicated. It is then washed, once or twice beetled, and dried without wringing, that its elasticity may not be destroyed. Raw silk may be dyed by a more speedy process. After galling, it may be turned or shaken over in the cold bath; and thus, by alternately dipping and airing the stuff, the operation may be completed. It is then to be washed and dried, as in the former process.

Improved
process for
velvet.

The method of dyeing velvet at Genoa, which has been simplified and improved in France, is thus described by Macquer. For every hundred pounds of silk, twenty pounds of Aleppo galls, reduced to powder, are boiled in a sufficient quantity of water for an hour. The bath is allowed to settle till the galls have fallen to the bottom; they are then taken out, and two pounds and a half of sulphuric acid, twelve pounds of iron filings, and twenty pounds of gum, are put into a copper vessel, or cullender, furnished with two handles. This vessel is immersed in the bath, and supported that it may not touch the bottom. The gum, which is allowed to dissolve for an hour, is to be occasionally stirred; and if it appear that the whole of the gum is dissolved, three or four pounds more are to be added. Excepting during the operation of dyeing, the cullender is to remain in the copper, which must be kept hot the whole time, but at a temperature below the boiling point. In galling the silk, one third of Aleppo galls is employed, and the stuff should remain six hours in the liquor the first time, and twelve hours the second. By frequent additions of sulphate of iron, and repeated immersions of the stuff, a fine black, according to Lewis, has been obtained. In the above process, the proportion of sulphate of iron is too small; and the gum, according to some, being carried off in the washing, may be considered as useless. Berthollet thinks, that although the quantity be excessive, it has some effect in keeping up the bath; and he adds, if it is to be diminished, it would be useful to add the sulphate of iron in separate portions during each interval.

To diminish the quantity of galls, which are an expensive ingredient in dyeing silk black, other substances have been proposed as substitutes. With this view the following process is recommended.

Simple
Colours.
Substitute
for galls.

The silk being boiled and washed, is immersed in a strong decoction of green walnut peels, and allowed to remain till the colouring matter of both is exhausted. It is then to be slightly wrung out, dried, and washed.¹ To give the silk a blue ground, logwood and verdigris are employed, in the proportion of one ounce of the latter for every pound of silk. The verdigris is dissolved in cold water, and the silk is allowed to remain two hours in this solution. It is then immersed in a strong decoction of logwood, slightly wrung out, dried, and afterwards washed at the river. The bath is prepared by macerating two pounds of galls and three of sumach in twenty-five gallons of water, over a slow fire, for twelve hours. The liquid being strained, three pounds of sulphate of iron and the same quantity of gum-arabic are to be dissolved in it. The silk is dipped in this solution at two different times; it is to remain in the bath two hours each time, and it must be aired and dried between each dip. After being twice beetled at the river, it is dipped a third time, and left in the bath four or five hours, after which it is to be dried, washed, and beetled, as before. The temperature of the bath should not exceed 120°. After the first dipping, it may be necessary to add half a pound of sulphate of iron, and an equal quantity of gum-arabic.

Silk which has been previously dyed blue with indigo, it is said, takes only a mealy black; but when it has been prepared with logwood and verdigris, it acquires a velvety lustre. A fine black may be obtained from green walnut peel; but the addition of logwood and verdigris renders a smaller quantity of sulphate of iron necessary, and this is of importance, because it is apt to weaken the silk. The only use of galls, according to some, is to increase the weight of the silk; for the purposes of dyeing, sumach is considered sufficient.²

IV.—Of the Processes for dyeing Cotton and Linen Black.

It is more difficult to communicate a fine black to linen or cotton than to silk or woollen stuffs. To succeed in producing a black colour of that degree of intensity which will resist soap, it is necessary to adopt particular processes. In dyeing animal matters black, as silk and wool, the best colours are obtained on those which have been previously dyed blue. This also is an essential preliminary process in dyeing linen and cotton black; for it is found that the process which succeeds best is first to give a deep blue grain to the cotton or linen.

The first part of the process is the operation of galling. The stuffs, which have been previously dyed blue, wrung out, and dried, are kept twenty-four hours in the gall liquor, composed of four ounces of galls to every pound of thread. A bath is then prepared of a solution of iron in acetic acid. This solution is obtained by saturating the acid with oxide of iron. In France, vinegar, small beer, or small wine, is employed for this purpose. To promote the acid fermentation, rye meal, or some other substance, is added, and pieces of old iron are thrown into the liquid, which are allowed to remain for six weeks or two months, that the acid may be saturated with the iron. This solution, called *iron liquor* in this country, is prepared from fermented worts, to which old iron is added, as is described above. Five quarts of the iron liquor for every pound of stuffs are put into a vessel. In this the stuffs are wrought with the hand, pound by pound, for fifteen mi-

¹ The decoction of walnut peels is prepared by boiling for fifteen minutes, after which it is taken from the fire. After it has subsided, the silk, which has been previously immersed in warm water, is dipped in it.

² Berthollet, ii. 20.

Simple Colours.

Simple Colours.

nutes; they are then wrung out and aired. This operation is to be again repeated, taking care to add a fresh quantity of the iron liquor, which should be carefully scummed, after which the stuffs are to be wrung out, aired, and washed at the river. In the next operation, a pound of alder bark for every pound of stuff is boiled in a sufficient quantity of water for an hour. One half of the bath which was employed in the galling, and about one half the quantity of sumach as of alder bark, are then added. The whole is boiled together for two hours, and strained through a sieve. When this liquid is cold, the stuffs are immersed, wrought pound by pound, and occasionally aired. They are afterwards put into the bath, and, after remaining for twenty-four hours, are wrung out and dried. The above is the process which, according to D'Apligny, is followed at Rouen for dyeing cotton and linen.

Another process.

The process followed at Manchester, which is described by Mr Wilson, is the following. For the operation of galling, galls or sumach are employed. The stuff is afterwards dyed in a bath consisting of a solution of iron in acetic acid. This bath is also frequently composed of alder bark and iron. After having passed through this bath, the stuff is dipped in a decoction of logwood, to which a small quantity of verdigris has been added. This process is to be repeated till a black of sufficient intensity is obtained, observing to wash and dry after each operation.

Preparation of solution of iron.

According to Guhliche, a solution of iron may be prepared by the following process. A pound of rice is to be boiled in twelve or fifteen quarts of water, till the whole is dissolved. A sufficient quantity of old iron made red hot, to reach half way to the surface of the liquor, is thrown into the solution. The vessel in which the solution is kept must be under cover, but exposed to the air and light, at least for a week. In another vessel, containing a quantity of warm vinegar equal to the solution of rice, an equal quantity of red-hot iron is to be put. This vessel must also be exposed in the same way to the air and light. After several days, the contents of both vessels are mixed together, and the mixture is to be exposed for a week to the open air, after which it is to be decanted and kept for use in a close vessel. To give a sufficient black to linen and cotton, it is only necessary, it is said, to steep them twenty-nine hours in this solution; and if it should appear that the liquor is exhausted of colouring matter, a fresh portion is to be employed. In this way a fine permanent black is obtained. According to the same author, this solution may be advantageously employed as a substitute for sulphate of iron, in dyeing silk and wool. But to give them a fine black, silk and woollen stuffs must be dipped in a decoction of logwood after they are taken from the bath.

Its application.

SECT. V.—Of Brown.

The last of the simple colours is brown. This is also known under the name of *fawn* colour (*fauve*, Fr.). It is that brown colour which has a shade of yellow, and might perhaps be considered as a compound colour, although it is communicated to stuffs by one process.

I.—Of the Substances employed in Dyeing Brown.

Walnut peels.

The vegetable substances which are capable of inducing a fawn or brown colour on different stuffs are very numerous, but those chiefly employed for this purpose are walnut peels and sumach. The peels constitute the green covering of the nut; they are internally of a white colour, which is converted into brown or black by exposure to the air. The skin, when impregnated with the juice of walnut peels, becomes of a brown or almost black

colour. When the inner part of the peel, taken fresh, is put into weak oxymuriatic acid, it assumes a brown colour. If the decoction of walnut peels be filtered and exposed to the air, its colour becomes of a deep brown; the pelli- cles on evaporation are almost black; the liquor detached from these yields a brown extract, completely soluble in water. The colouring particles are precipitated from a decoction of walnut peels by means of alcohol, and they are soluble in water. No apparent change is at first produced by a solution of potash; but it gradually becomes turbid, and the colour is deepened. A copious precipitate, of a fawn colour, approaching to an ash colour, is produced in a decoction of walnut peels, by means of a solution of tin, and the remaining liquor has a slightly yellow tinge.

A decoction of walnut peels yields a small quantity of fawn-coloured precipitate by means of a solution of alum, and the liquor remains of the same colour. Sulphate of copper renders it slowly turbid, and throws down a small quantity of precipitate of a brownish-green colour, leaving the supernatant liquor of the same colour. Sulphate of iron deepens the colour; when diluted, the colour becomes brownish green, without the deposition of any sediment. Sulphate of zinc also deepens the colour, and produces no precipitate. The same properties are exhibited by a decoction of the walnut-tree wood, but the colouring matter is not obtained from it in such abundance as from the peels; and the bark may also be used with advantage in dyeing.

The affinity of the colouring matter of walnut peels for wool is very strong; and it readily imparts to it a durable colour, which even mordants do not seem capable of increasing, but they are generally understood to give it additional brightness. A lively and very rich colour is obtained with the assistance of alum. Walnut peels afford a great variety of pleasing shades; and as they require not the intervention of mordants, the softness of the wool is preserved, and the process of dyeing becomes both cheap and simple.

Walnut peels are not gathered till the nuts are completely ripe, when they are put into large casks, along with as much water as is sufficient to cover them. When used in dyeing at the Gobelins in Paris, Berthollet informs us, they are kept for upwards of a year, and very extensively used; but if not made use of till the end of two years, they yield a greater quantity of colouring matter, at which time their odour has become peculiarly disagreeable and fetid. The peels separated from the nuts before they arrive at maturity, may likewise be used in dyeing, but in this state they do not keep so long.

Sumach (*rhus coriaria*, Lin.) is a shrub produced naturally in Palestine, Syria, Portugal, and Spain, being carefully cultivated in the last two of these countries. Its shoots are annually cut down, dried, and reduced to powder in a mill, by which process they are prepared for the purposes of dyeing.

The infusion of sumach, which is of a fawn colour with a greenish tinge, is changed into a brown by exposure to the air. A solution of potash has little action on the recent infusion of sumach; its colour is changed to yellow by the action of acids; the liquor becomes turbid by means of alum, a small quantity of precipitate being at the same time formed, and the supernatant liquor remaining yellow. A copious precipitate of a yellowish-green colour is thrown down by sulphate of copper, and the liquor remains clear. No change is speedily produced by muriate of soda (common salt), but it becomes rather turbid at the end of some hours, and its colour is rather clearer. Sulphate of copper produces a copious precipitate of a yellowish green, which after standing some hours changes to a brownish green; the supernatant liquor, which is slightly

Properties.

Advantages.

Preparation.

Sumach.

Properties.

Simple
Colours.

yellow, remains clear. Sulphate of zinc renders the liquor turbid, darkens its colour, and produces a deep blue precipitate; but when the sulphate of zinc is pure, the precipitate, which is of a brownish fawn colour, is in very small quantity. Acetate of lead gives a copious precipitate of a yellowish colour; the supernatant liquor is of a clear yellow colour. No astringent has so strong a resemblance to galls as sumach; but the precipitate thrown down from an infusion of it by a solution of iron, is not so copious as that which is yielded by an equal quantity of galls, on which account sumach may be generally employed as a substitute for galls, only its quantity will require to be increased.

Bark of
birch.

The bark of the birch tree (*betula alba*, Lin.) yields a decoction of a clear fawn colour, but it soon becomes turbid and brown. The addition of a solution of alum, in the open air, produces a copious yellow precipitate; a solution of tin gives also a copious precipitate of a clear yellow colour. With solutions of iron the decoction of the birch tree strikes a black colour, and it dissolves in considerable quantity the oxide of iron, but in smaller proportion than the decoction of walnut peels. On account of this property, it is employed in the preparation of black vats for dyeing thread.

Sandal
wood.

Sanders or sandal wood (*Petrocarpus sachtalinus*) is also employed for the purpose of giving a fawn colour. There are three kinds of sandal wood, the white, the yellow, and the red. The last only, which is a compact heavy wood, brought from the Coromandel coast, is used in dyeing. By exposure to the air it becomes of a brown colour; when employed in dyeing, it is reduced to fine powder, and it yields a fawn colour with a brownish shade, inclining to red. But the colouring matter which it yields of itself is in small quantity, and it is said that it gives harshness to woollen stuffs. When it is mixed with other substances, as sumach, walnut peels, or galls, the quantity of colouring matter is increased; it gives a more durable colour, and produces considerable modifications in the colouring matter with which it is mixed. Sandal wood yields its colouring matter to brandy, or diluted alcohol, more readily than to water.

Soot.

Soot communicates to woollen stuffs a fawn or brown colour, of a lighter or deeper shade, in proportion to the quantity employed; but the colour is fading, and its affinity for wool is not great; and besides leaving a disagreeable smell, it renders the fibres harsh. In some manufactories it is employed for browning certain colours, and it produces shades which could not otherwise be easily obtained.

II.—Of the Processes for dyeing Woollen, &c. a Fawn or Brown Colour.

With wal-
nut peels.

In dyeing with walnut peels, a quantity proportioned to the quantity of stuff, and the intensity of shade wanted, is boiled for fifteen minutes in a copper. All that is necessary in dyeing with this substance is, to moisten the cloth or yarn with warm water previous to its immersion in the copper, in which it is to be carefully stirred till it has acquired the proper shade. This is the process if the aluminous mordant is not employed. In dyeing cloth, it is usual to give the deepest shades first, and the lighter ones afterwards; but in dyeing woollen yarn, the light shades are given first, and the deeper ones afterwards. An additional quantity of peels is joined to each parcel.

Berthol-
let's expe-
riments.

Berthollet made a number of experiments to ascertain the difference of colour obtained from the simple decoc-

tion of walnut peels, and the addition of metallic oxides as mordants. The oxide of tin, he found, yielded a clearer and brighter fawn colour than that of the simple decoction. The oxide of zinc produced a still clearer colour, inclining to ash or gray. The colour from oxide of lead had an orange cast, while that from oxide of iron was of a greenish brown.¹

Compound
Colours.

A fawn colour, which has a shade of green, is obtained from sumach alone; but to cotton stuffs which have been impregnated with printers' mordant, or acetate of alumina, sumach communicates a good and durable yellow. Here, however, some precaution is necessary in the use of this substance for this purpose; for as the colouring matter is of so fixed a nature, the ground of the stuff cannot be bleached by exposure on the grass. This inconvenience is avoided by impregnating the whole of the stuff with different mordants, producing in this way a variety of colours, and leaving no part white.

Dyeing
with su-
mach.

Vogler employed the tincture of sanders wood for dyeing patterns of wool, silk, cotton, and linen, having previously impregnated them with a solution of tin, and afterwards washing and drying them. Sometimes he used the solution unmixed, and at other times added six or ten parts of water, and in whatever way he employed it he obtained a poppy colour. When the mordant employed was the solution of alum, the colour was a rich scarlet; with sulphate of copper it was a clear crimson, and with sulphate of iron a beautiful deep violet.²

With san-
dal wood.

CHAPTER V.

OF COMPOUND COLOURS.

A mixture of two colouring substances, it is well known, produces a very different shade from that of either of the uncombined colouring matters; hence compound colours are obtained, which are merely mixtures of simple colours. It would undoubtedly be a desirable thing to ascertain with accuracy the peculiar shade produced by the combination of two colouring matters; but these results can only be certainly known by experiment, because by the action of different substances in the bath they are subject to great variations in their effects, according to the affinities which are brought into action, and the new combinations which are formed. What is natural to colouring particles is not to be considered as a constituent part of compound colours, but only the difference of shade which they ought to assume with a particular mordant, or in a particular bath. The effects, therefore, of the chemical agents employed in these processes, and the result of different combinations, ought to be particularly attended to. It is in dyeing compound colours that skill and ingenuity are most conspicuous, and their application of greatest utility, to enable the dyer to vary his processes according to the shade desired, and at the same time to accomplish his operations by the shortest and cheapest means.

Nature of
compound
colours.

As compound colours are obtained by the mixture of simple colours, very different shades will be obtained from different proportions of the simple colours; hence compound colours exhibit an indefinite variety of shade, and the processes by which they are produced are very numerous. It would extend this treatise to an unusual length were we to attempt to describe every variety of shade which is obtained from the mixture of simple colours. We shall therefore limit our observations to some of the principal

Great va-
riety of
shade.

¹ Elements of Dyeing, ii. 296.

² Crell. Ann. 1790

Compound Colours. compound colours, and an account of the processes by which they are obtained, leaving it to our readers, who have made themselves familiar with the principles already detailed, to vary these colours by employing different proportions and different combinations of simple colouring matters.

Compound colours have been usually divided into four classes, namely, green, purple, orange, and gray or drab colour. These are obtained from mixtures of the following simple colours:

1. Blue and yellow produce a green.
2. Red and blue produce a purple, &c.
3. Red and yellow produce orange.
4. Black and other colours produce gray, &c.

The following sections will be occupied in a short detail of the methods which are usually employed in producing these different compound colours.

SECT. I.—Of the Mixture of Blue and Yellow, or Green.

Various shades of green.

Green colours, from the great variety of shades which they exhibit, have been long known by different names, by which the intensity of shade is characterized, such as sea-green, apple-green, meadow or grass-green, pea-green, parrot-green, &c. Many plants afford a green colour, such as brome grass (*bromus secalinus*, Lin.) green berries of *rhamnus frangula*, wild chervil (*chærophyllyllum sylvestre*, Lin.), purple clover (*trifolium pratense*), common reed (*arundo phragmites*). These colours, however, do not possess sufficient permanency. According to D'Ambourney, indeed, a permanent green may be obtained from the fermented juice of the berries of the berry-bearing alder (*rhamnus frangula*). Having previously prepared the cloth with tartar, solution of nitrate of bismuth, and common salt, he added to the fermented juice of the berries, after it was warmed, a small proportion of acetate of lead; and in this bath he communicated to the cloth an intermediate shade between parrot and grass green. But it is usually from the mixture of blue and yellow that green is obtained; and it may be observed, that it requires much skill and experience, especially in giving light shades, to produce a colour which is uniform and entirely without spots.

I.—Of the Processes for dyeing Woollen Stuffs Green.

Common process.

To dye woollen green, either the yellow or the blue dye may be given to it first. But when the stuff is first dyed yellow, and in this state is introduced into the blue vat, part of the yellow colouring matter being dissolved in the vat, communicates to it a green colour, which renders it unfit for dyeing any other colour than green. To avoid this inconvenience, therefore, the blue colour is first given, and afterwards the yellow. It would be quite unnecessary to resume the account of any part of the processes for dyeing blue, which have been already detailed. It is proper, however, to add, that the intensity of the blue shade must be proportioned to the green, or to the depth of the green colour which is wished to be obtained. Thus, for instance, to produce a parrot green, a ground of sky blue is given, and for the green like that of a drake's neck, a deep blue is required. When the blue dye has been communicated, the yellow is afterwards given, according to some of the processes which have been already described for dyeing yellow. The proper ground being communicated to the cloths, they are washed in the fulling mill, and boiled as for the common process of welding; but when the shade is light, the proportion of salts should be less. Cloths which are to receive light shades are first boiled, and when these are taken out, tartar and alum are added in fresh portions till the cloths which are intended for the darkest shades are boiled. The process of welding is conducted

in the same way as for dyeing yellow, with this difference, that a larger proportion of weld is employed, excepting for lighter shades, when the proportion must be smaller. In dyeing green, it is usual to have a succession of shades at the same time; the process is begun with the deepest and ends with the lightest. Between each dip there should be an interval of one half or three quarters of an hour, and at each interval water is added to the bath. It is the practice of some dyers to give each parcel two dips, beginning the first time with the deep shades, and the second with the lighter ones; but when this practice is followed, the time of immersion should be shortened. In dyeing very light shades, the bath should never be permitted to reach the boiling temperature. For deep greens, a browning is given with logwood and a small proportion of sulphate of iron.

For some kinds of green, sulphate of indigo is employed; Saxon and in this case either the blue and yellow are dyed separately, or the whole of the ingredients are mixed together in the bath, and the whole process is finished at a single operation. The colour thus obtained has been distinguished by the name of *Saxon green*. The following is the process recommended by Dr Bancroft.

"The most beautiful Saxon green," says he, "may be produced very cheaply and expeditiously, by combining the lively yellow which results from quercitron bark, murio-sulphate of tin, and alum, with the blue afforded by indigo when dissolved in sulphuric acid, as for dyeing the Saxon blue.

"To produce this combination most advantageously, the dyer, for a full-bodied green, should put into the dyeing vessel after the rate of six or eight pounds of powdered bark in a bag for every 100 pounds weight of cloth, with only a small proportion of water as soon as it begins to grow warm; and when it begins to boil, he should add about six pounds of murio-sulphate of tin (with the usual precautions), and a few minutes after, about four pounds of alum. These having boiled together five or six minutes, cold water should be added, and the fire diminished so as to bring the heat of the liquor nearly down to what the hand is able to bear; and immediately after this, as much sulphate of indigo is to be added as will suffice to produce the shade of green intended to be dyed, taking care to mix it thoroughly with the first solution by stirring, &c.; and this being done, the cloth, previously scoured and moistened, should be expeditiously put into the liquor, and turned very briskly through it for a quarter of an hour, in order that the colour may apply itself equally to every part, which it will certainly do in this way with proper care. By these means, very full, even, and beautiful greens may generally be dyed in half an hour; and during this space it is best to keep the liquor at rather less than a boiling heat. Murio-sulphate of tin is infinitely preferable for this use to the dyer's spirit, because the latter consists chiefly of nitric acid, which, by its highly injurious action upon indigo, would render that part of the green colour very fugitive, as I have found by repeated trials. But no such effect can result from the murio-sulphate of tin, since the muriatic acid has no action upon indigo; and the sulphuric is that very acid which alone is proper to dissolve it for this use.

"Respecting the beauty of the colour thus produced, those who are acquainted with the unequalled lustre and brightness of the quercitron yellows, dyed with the tin basis, must necessarily conclude that the greens composed therewith will prove infinitely superior to any which can result from the dull muddy yellow of old fustic; and in point of expense it is certain that the bark, murio-sulphate of tin, and alum, necessary to dye a given quantity of cloth in this way will cost less than the much greater quantity

Compound Colours. (six or eight times more) of fustic, with the alum necessary for dyeing it in the common way, the sulphate of indigo being the same in both cases. But in dyeing with the bark, the vessel is only to be filled and heated once, and the cloth, without any previous preparation, may be completely dyed in half an hour: whilst in the common way of producing Saxon greens, the copper is to be twice filled; and to this must be joined the fuel and labour of an hour and a half's boiling and turning the cloth in the course of preparation, besides nearly as much boiling in another vessel to extract the fustic; and after all, the dyeing process remains to be performed, which will be equal in time and trouble to the whole of the process for producing a Saxon green with the bark; so that this colour obtained from bark will not only prove superior in beauty, but in cheapness, to that dyed as usual with old fustic.¹

II.—Of the Processes for dyeing Silk Green.

Preparation.

In giving silk a green colour, greater precaution is necessary, to preserve uniformity of colour, and to prevent spots and stripes. Silk which is intended to receive a green colour is scoured in the same way as for other colours; but for light shades the scouring must be as complete as for blue. Silk which is to be dyed green is first dyed yellow, and being well alumed, it is slightly washed at the river, and divided into small parcels, that it may receive the colouring matter uniformly, and then carefully turned in the weld bath. When the ground is supposed to have acquired a sufficient degree of intensity, a pattern is put into the blue vat to ascertain the proper shade. When this is the case, the silk is taken out of the bath, washed, and immersed in the blue vat. To produce a deeper colour, and at the same time to give variety of shade, a decoction of logwood, fustic, or anotta is added to the yellow bath, after the weld has been taken out. For very light shades, such as apple and sea green, it is scarcely necessary to add, that a weaker ground is to be given. For all light shades, except sea-green, the process is found to succeed better when the yellow is communicated by baths which have been already used; but these baths should not contain any logwood or fustic.

Saxon green.

Saxon green is produced by means of sulphate of indigo. This is a brighter but less durable colour than the former. This process is conducted by boiling as for welding, after which the cloth is washed. Fustic in chips is enclosed in a bag, put into the same bath, and boiled for an hour and a half, when it is taken out, and the bath allowed to cool till the hand can bear it. A pound and a quarter of sulphate of indigo for each piece of cloth of eighteen yards is added. The cloth is at first to be turned quickly, and afterwards more slowly, and it should be taken out before the bath boils. Some dyers put in only two thirds of the solution at first, and after two or three turns take out the cloth and add the other one third. By this means the colour is more uniform.

By one operation.

To produce Saxon green at one operation, the following process is recommended by Dr Bancroft. A bath is prepared of four pounds of quercitron bark, three pounds of alum, and two pounds of murio-sulphate of tin, with a sufficient quantity of water. The bath is boiled ten or fifteen minutes, and when the liquor is so far reduced in temperature as the hand can bear it, it is fit for dyeing. By adding different proportions of sulphate of indigo, various and beautiful shades of green may be obtained, and the colour thus produced is both cheap and uniform. Care should be taken to keep the bath constantly stirred, to prevent the colouring matter from subsiding. Those shades

which are intended to incline most to the yellow should be dyed first; and by adding sulphate of indigo, the green having a shade of blue may be obtained. This process, Dr Bancroft observes, is the most commodious and certain for dyeing most beautiful Saxon greens upon silk.²

To produce English green, which is more beautiful than common green, and is said to be more durable than the Saxon green, Guhliche gives the following process. He first dyes the silk of a light blue in the cold vat already described, then soaks it in warm water, washes it in a stream, and dips it in a weak solution of alum. He then prepares a bath of sulphate of indigo, one ounce of solution of tin, with the tincture of French berries made with aceto-citric acid. The silk is kept in this bath till it has obtained the desired colour. It is then washed and dried in a shady place. Lighter shades may be dyed afterwards.³

III.—Of the Processes for dyeing Cotton and Linen Green.

Cotton and linen, after being scoured in the usual way, are first dyed blue, and after being cleansed, they are dipped in the weld bath, to produce a green colour. The strength of the blue and yellow is proportioned to the shade of green which is wanted. But as it is difficult to give to cotton velvet a uniform colour in the blue vat, it is first dyed yellow with turmeric, and the process is completed by giving it a green with sulphate of indigo. The same result, however, will be obtained by commencing the process either with the yellow or the blue.

The process which D'Apligny describes for dyeing cotton velvet, or cotton thread, a sea or apple green, in one bath, is the following. A quantity of verdigris is dissolved in vinegar, and the mixture is kept excluded from the air in the heat of a stove for fifteen days. A quantity of potash equal in weight to the verdigris employed is dissolved in water, and, four hours before dyeing, it is added to the solution of verdigris. The mixture is to be kept hot. One ounce of alum in five quarts of water for each pound of stuff being prepared, the cotton thread or velvet is soaked in this solution. It is then taken out, and the verdigris being added to the solution of alum, it is again introduced to be dyed.

The different shades of olive green, and drake's neck green, are given to thread after it has received a blue ground, by galling it, and dipping it in a weaker or stronger bath of iron liquor, then in the weld bath, to which verdigris has been added, and afterwards in the bath with sulphate of copper. The colour is lastly to be brightened with soap.

Cotton dyed with Prussian blue may be dyed green by previously aluming while it is still wet with the blue, and then dipping in a weld bath, the strength of which is proportioned to the shade required. The colour from weld is more lively than that obtained from fustic. But fustic, which gives a deeper shade than weld, and diminishes the brightness of the blue, is to be preferred when a green with an olive shade is wanted.

The shade of green given to any stuff, it is obvious, must vary according to the intensity of the blue shade, the strength of the yellow bath, and the nature of the yellow colouring matter employed. Yellow colours are rendered more intense by means of alkalies, sulphate of lime, and ammoniacal salts; but become fainter by means of acids, alum, and solutions of tin. In dyeing Saxon green the result will be different according to the process which is followed. The effects will be different by adding a yellow to a Saxon blue, from the process in which the sulphate of indigo is mixed with the yellow ingre-

¹ Phil. of Perm. Col. 336.

² Ibid. 346.

³ Berthollet, ii. 319.

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Colours.

dients; because in the latter case the sulphuric acid has a considerable action on the colouring matter, and thus diminishes the intensity of the yellow. As the particles of indigo have a stronger affinity for the stuff than the yellow colouring matter, in dyeing a succession of shades in a bath in which both are mixed, the bath being first exhausted of the indigo, the last shades incline more to the yellow, on account of the predominance of the yellow colouring matter.

SECT. II.—Of the Mixture of Red and Blue, or Purple, &c.

By the mixture of red and blue, violet, purple, dove-colour, lilac, and a great variety of other shades, according to the proportion of the substances employed, or the predominance of the blue or the red, are produced. In stuffs which are to be dyed violet, a deeper blue must be given; for purple colours, the ground requires to be of a lighter blue; but in lilac and other light colours, it is necessary that both the blue and the red have a light shade.

I.—Of dyeing Wool Violet, Purple, &c.

In the attempts which have been made to communicate a violet or purple colour to a scarlet ground, according to the observations of Hellot, the colour is very unequal. It becomes therefore necessary to give the blue colour first; and for violets or purples, the shade of blue ought not to be deeper than that of sky blue. The stuff being dyed blue, is boiled with alum, and two fifths of tartar, and is afterwards dipped in a bath composed of nearly two thirds the quantity of cochineal required for scarlet, with the addition of tartar. The same process, indeed, as for dyeing scarlet, is followed. It is a common practice to dye these colours after the reddening for scarlet, making such additions of cochineal and tartar as the intensity of the shade may require.

Lilac, &c.

For lighter shades, as lilacs, dove-colours, &c. the stuff may be dipped in the bath which has served for violet and purple, and is now somewhat exhausted, taking care to add a quantity of alum and tartar. For reddish shades, such as a peach-blossom, a small proportion of solution of tin is added. It may be observed in general, that although the proportion of cochineal is less in dyeing lighter shades, the quantity of tartar must not be diminished.

Cheaper
and shorter
process.

To obtain the same colours, a shorter and less expensive process is recommended by Poerner. In this process he employs sulphate of indigo. He boils the stuff in a solution of alum, in the proportion of three ounces of the latter to one pound of the former, for an hour and a half, and afterwards allows it to remain in the liquid for a night after it has cooled. The dyeing bath is prepared with an ounce and a half of cochineal, and two ounces of tartar, which are boiled for three quarters of an hour: two ounces and a half of sulphate of indigo are then added, the whole is stirred, and boiled gently for fifteen minutes. The dyeing operation is conducted in the usual way, and a beautiful violet is thus obtained. To have all the variety of shades which are produced by the mixture of red and blue, the proportion of the sulphate of indigo is increased or diminished. It is sometimes increased to five ounces, and diminished to five drachms, for each pound of stuff. The quantity of cochineal is also varied, but when it is less than an ounce the colour is dull. Different proportions of tartar are also employed. To produce variety of shades, the stuff is also prepared with different proportions of solution of tin.

Purple
from log-
wood.

To communicate a purple colour to wool, as well as some other shades, logwood, with the addition of galls,

has been employed. The stuff is previously dyed blue, and, to give a brown shade, sulphate of iron is used; but the colours thus obtained are not permanent. By the following process, described by Decroizille, a durable dye is produced by means of this wood. He dissolved tin in sulphuric acid, to which were added common salt, red acidulous tartrate of potash, and sulphate of copper; or it may be more conveniently done by making a solution of tin in a mixture of sulphuric acid, common salt, and water, to which are to be added the tartrate and sulphate in the state of powder. Of this mordant not less than 1500 quarts were made in twenty-four hours, in a leaden vessel to which a moderate heat was applied. A very lucrative trade was carried on for three years by Decroizille, who sold it at the rate of 1s. 3d. sterling per pound.

If wool in the fleece is to be dyed, it will require a third of its weight of this mordant, while a fifth is a proportion sufficient for stuffs. A bath is prepared of such a degree of temperature as the hand can bear, with which the mordant is properly mixed, and the wool or stuff dipped in it and stirred; the same degree of temperature being kept up for two hours, and increased a little towards the end; after which it is taken out, aired, and well washed. A fresh bath of pure water is prepared at the same temperature, to which is added a sufficient quantity of the decoction of logwood; the stuff is then immersed, stirred, and the heat increased to the boiling temperature, which is to be continued for fifteen minutes, after which, the stuff being taken out, aired, and carefully rinsed, the process of dyeing is completed. If for every three pounds of wool one pound of decoction of logwood has been used, and a proportionate quantity for stuffs which require less, a fine violet colour is produced, to which a sufficient quantity of Brazil wood imparts the shade known in France by the name of *prune de Monsieur*.

Logwood and Brazil, fustic and yellow wood, are different colouring substances which may be fixed with advantage upon wool by means of this mordant. The colour communicated by the two first of these is liable to be changed in the fulling by the action of the soap or urine employed for that purpose; but this change, which is always produced by alkaline substances, is remedied by a slightly acid bath a little hot, called *brightening*, for which the sulphuric acid has the preference. The colour becomes as deep, and frequently much brighter than before the change. Wools which have been dyed by means of this mordant are said to admit of being spun into a finer and more beautiful thread than by the use of alum. If the use of sulphate of copper is omitted, more beautiful colours are produced by fustic and yellow wood, as well as by weld. An orange-red colour is communicated by madder, but not so deep as with a similar quantity of alum. When sulphate of copper is omitted, the wool is said to become much harsher, and the mordant thus prepared yields but indifferent colours with logwood, and in particular with Brazil wood. The use and carriage of this mordant are inconvenient, on account of the heavy sediment by which the vessel is half filled under a corrosive liquor, capable only of being kept in stone ware. These inconveniences may be remedied by the omission of the water in the receipt, which leaves only a paste more conveniently used, and the carriage of it two fifths cheaper.

The above process is thus explained by Berthollet. The decomposition of the muriate of soda is effected by the action of the sulphuric acid; and the muriatic acid being thus disengaged, dissolves the tin, part of which is precipitated by means of the tartaric acid, producing the sediment already mentioned. The oxide of copper produces the blue with the colouring particles of the logwood; the violet is formed by the oxide of tin with the same wood,

Compound Colours. and the red with the colouring matter of the Brazil wood. The same ingenious chemist farther observes, that as an excess of acid is retained in the liquor, it might probably be of advantage to employ acetate as a substitute for sulphate of copper, in which case the action of the free acid would be moderated. He thinks it would still be more advisable to make use of verdigris; because the uncombined part of the oxide of copper would in that case unite with the excess of acid, on which account a smaller quantity of acid would remain in the liquor; and probably the quantity of tartar might be diminished, as a smaller quantity of tin would thus be precipitated.¹

II.—Of dyeing Silk Violet or Purple.

Two kinds of violet. Silk is capable of receiving two kinds of violet colours, denominated the fine and the false, the latter of which is produced by means of archil or Brazil wood. When the fine violet colour is required, the silk must first be passed through cochineal, and dipped afterwards in the vat. The preparation and dyeing of the silk with cochineal are the same as for crimson, with the omission of tartar and solution of tin, by means of which the colour is heightened. The quantity of cochineal made use of is always proportioned to the required shade, whether it is more or less intense; but the usual proportion for a fine violet colour is two ounces of cochineal for each pound of silk. When the silk is dyed it is washed at the river, twice beetled, dipped in a vat more or less strong in proportion to the depth of the violet shade, and then washed and dried with precautions similar to those which all colours require that are dyed in the vat. If the violet is to have greater strength and beauty, it is usual to pass it through the archil bath; a practice which, though frequently abused, is not to be dispensed with for light shades, which would otherwise be too dull.

Purple. When silk has been dyed with cochineal according to the above directions, only a very light shade is requisite for purple; the shades which are deepest are dipped in a weak vat, while dipping them in cold water is sufficient for such as are lighter, the water having been incorporated with a small quantity of the liquor of the vat, because in the vat itself, however weak it might be, they would acquire too deep a tinge of blue. In this manner are the light shades of this colour, such as gilly-flower, peach-blossom, &c. produced by diminishing the quantity of cochineal.

False violets. There are various ways of imparting to silk what are denominated the false violets; but those which are most frequently used, and possessed of greatest beauty, are prepared with archil, the bath of which is, in point of strength, to be suited to the colour required. Having been beetled at the river after scouring, the silk is turned in the bath on the skein sticks; and when the colour is deemed sufficiently deep, a pattern is tried in the vat, to ascertain whether it takes the violet colour intended to be produced. If the shade is found to have acquired the proper depth, the silk is beetled at the river and dipped in the vat, in the same way as for the fine violet colours; and less either of the blue or of the archil colour is given, according as it is meant that the red or blue shade of the violet colour should predominate.

Process of Gühliche. The process recommended by Gühliche for communicating a violet colour to silk is the following. A pound of silk is to be soaked in a bath of two ounces of alum and a like quantity of solution of tin, after having carefully poured off the sediment formed in the mixture. The dye-bath is prepared with two ounces of cochineal re-

Compound Colours. duced to powder, with a drachm of tartar, and the remaining part of the bath, which has answered the purpose of a mordant, with the addition of a sufficient quantity of water. When slightly boiled, such a quantity of solution of indigo is added as may communicate to the bath a proper shade of violet; after which the silk is immersed, and boiled till it has acquired the intended shade. It is then wrung, washed in a stream, and, like every other delicate colour, must be dried in the shade. The light shades exhaust the bath. But it ought to be observed that this colour, which is said to be a beautiful violet, possesses but little durability, and is apt to assume a reddish tinge, owing to the colour of the indigo fading first.

Another. A violet colour may be imparted to silks by immersing them in water impregnated with verdigris, as a substitute for aluming, and next giving them a bath of logwood, in which they assume a blue colour, which is converted to a violet, either by the addition of alum to the bath, or by dipping them in a weaker or stronger solution of that substance, which communicates a red colour to the particles of logwood. This violet possesses but a small degree of beauty, and little durability; but if alumed silk be immersed in a bath of Brazil wood, and next in a bath of archil, after washing it at the river, a colour is obtained possessing a much higher degree of beauty and intensity. The process described above for dyeing wool succeeds equally well, according to M. Decroizille, in communicating to silk a violet colour.

III.—Of dyeing Cotton and Linen Violet.

Common process. The most ordinary mode by which a violet colour is communicated to cotton and linen stuffs, is first to give them a blue ground in the vat, proportioned to the required shade, and to dry them. They are afterwards galled, in the proportion of three ounces of galls to a pound of stuff, and being left in this bath for twelve or fifteen hours, are wrung out and dried again. They are next passed through a decoction of logwood, and when thoroughly soaked and taken out, the bath receives an addition of two drachms of alum and one of dissolved verdigris for each pound of cotton or thread. The skeins are then dipped again on the skein sticks, and turned for about fifteen minutes, when they are taken out and aired. They are next immersed in the bath for fifteen minutes, taken out, and wrung. To complete the process, the vat employed is emptied; half of the decoction of logwood not formerly made use of is now poured in, with the addition of two drachms of alum, and the thread is again dipped in it till it has acquired the shade proposed, which must always regulate the strength or weakness of the decoction of logwood. This colour resists in a considerable degree the action of the air, but in point of permanency is much inferior to that which is obtained from the use of madder.

SECT. III.—Of the Mixtures of Yellow and Red, or Orange.

Orange is the usual result of a composition of yellow and red colours; but an almost endless variety of shades may be produced, according as we vary the proportion of the ingredients, and the particular nature of the yellow made use of. It is sometimes the practice of dyers to combine blue with yellow and red, the result of which is the colour denominated *olive*. Many varieties may be obtained from the use of weld, saw-wort, dyers-weed, and other yellows, and by employing tartar, alum, sulphate of zinc, or sulphate of copper, in the bath, or in the preparation of the cloth.

¹ Berthollet, ii. 340.

Compound
Colours.Orange by
the scarlet
process.

I.—Of dyeing Wool Orange.

By a process exactly the same as that which is followed in communicating to stuffs a scarlet colour, an orange may be given to wool; but the quantity of red must be diminished, and that of the yellow increased. If wool is dyed a red colour by means of madder, and afterwards yellow with weld, the resulting compound is a cinnamon colour, and the most proper mordant in this case is a mixture of alum and tartar. The shades may be varied at pleasure by substituting other yellow dyestuffs instead of weld, and by varying the proportions as circumstances may require. Wool may receive a reddish yellow colour by passing it through a madder bath, after it has undergone the usual process for yellow, which has already been described. The strength of the madder bath is always to be proportioned to the shade required. Brazil wood is sometimes employed with yellow substances, or mixed with cochineal and madder. Snuff, chestnut, musk, and other shades are produced by substituting walnut-tree root, walnut peels, or sumach, for weld.

II.—Of Dyeing Silk Orange, &c.

Marone,
&c.

Logwood, Brazil wood, and fustic, communicate to silk a marone and cinnamon colour, together with all the intermediate shades. The silk is scoured in the usual manner, alumed, and a bath is prepared by mixing together decoctions of the three different woods mentioned above, made separately, varying the quantity of each according to the shade intended to be given; but the proportion of fustic should be greatest. The silk is turned in the bath on the skein sticks, and when it is taken out, if the colour be uniform, it is wrung and again dipped in a second bath of these three ingredients, according to the effect produced by the first, in order to obtain the shade required.

Olive.

The blue vat is not made use of when an olive colour is to be communicated to silk. After being alumed, it is dipped in a bath of weld, which is made very strong. To this is afterwards added the juice of logwood, with a small quantity of solution of alkali when the silk is dipped. This converts it into green, and gives the olive colour. It is dipped again in this bath till it has acquired the shade wanted.

To communicate to it the colour known by the name of *rotten olive*, fustic and logwood are added to the bath after welding, without any alkali. If the colour wanted is to incline more to a red, the addition of logwood alone is sufficient. A sort of reddish olive may likewise be obtained by dyeing the silk in a fustic bath, to which a greater or less quantity has been added of sulphate of iron and logwood.

III.—Of dyeing Cotton and Linen Orange, &c.

Cinnamon
colour.

A cinnamon colour is communicated to thread and cotton by commencing the process for dyeing them with verdigris and weld; they are afterwards to be dipped in a solution of sulphate of iron, denominated by the French *bain d'assurance*, and then wrung out and dried. As soon as they are dried, they are galled in the proportion of three ounces to the pound of stuff; then dried again, alumed as for red colours, and maddered. After being washed and dried, they are put into hot soap suds, and turned till they have acquired a sufficient degree of brightness. It is the practice of some dyers to add to the aluming a decoction of fustic.

Olive.

By boiling four parts of weld and one of potash in a sufficient quantity of water, M. d'Apligny informs us, a fine olive colour is communicated to cotton and thread. Brazil wood which has been steeped for a night is boiled separately with a small quantity of verdigris, and these solu-

tions are mixed together in various proportions, according to the particular shade required. The thread or cotton is dipped in the compound solution in the usual way.

Compound
Colours.

SECT. IV.—Of the mixture of Black with other Colours.

The compound colours which are obtained from the mixture of black and other colours, are brown, gray, drab, &c. according to the nature and proportions of the simple colours employed.

I.—Of dyeing Woollen Stuffs Brown, Gray, &c.

To give a browning to cloth, as soon as it has been dyed, it is dipped in a solution of sulphate of iron, with the addition of an astringent, which makes a *black bath*. It is more common to mix a small quantity of solution of iron with a bath of water, adding more till the dyed stuff dipped in it has received the intended shade. Sulphate of iron is sometimes added to the dye bath; but by dipping the dyed stuff in a solution of this salt, the end is more easily attained. It is the usual practice of M. Poerner to soak the stuff in a solution of sulphate of iron, to which other ingredients are sometimes added; and after having taken it out of the mordant, it is dipped in the dye bath.

In order to obtain coffee and damascene colours, with other shades of browns of the common dye, the first method is adopted; a colour more or less deep is communicated to them, according to the shade intended to be obtained by the browning; and a bath is made of galls, sumach, and alder bark, with the addition of sulphate of iron. Those stuffs are first dipped to which the lightest shades are to be communicated, and when these are finished, the browner ones are dipped, a quantity of sulphate of iron being added for each operation, proportioned to the effect intended to be produced.

Bluish grays are communicated to stuffs, according to Gray. Poerner, by the solution of indigo in sulphuric acid, combined with a mixture of decoction of galls and sulphate of iron, varying the shades according to the different quantities of these ingredients made use of. If to a bath composed of cochineal, fustic, and galls, sulphate of iron be added, other shades are obtained.

For marone, and such other colours as bear a strong resemblance to it, sanders and galls are employed, and sometimes a browning with the addition of logwood. If dyed in the remains of a cochineal bath, these colours may be made to incline to a crimson or purple; and the same effect is produced by adding a small quantity of madder or cochineal to the bath. A little tartar gives a greater degree of brightness to the colour. With a mixture of galls, fustic, and logwood, and a greater or smaller quantity of madder, with the addition of a little alum, those colours may be communicated to stuffs which are known by the name of *hazel*.

Hazel.

M. Gühliche produces what is called a *puce* colour, by boiling for fifteen minutes a pound of woollen stuff with two ounces of alum, a certain proportion of vinegar and solution of iron, after which he leaves it in the mordant for twelve hours. He then makes a bath with the decoction of two ounces of white galls carefully poured off from the sediment, and mixed with four ounces of madder, in which, when it grows hot, the stuff is immersed, after being taken out of the mordant, allowing it to remain there, while the temperature is gradually increased, till the colour intended has been imparted to it; after which it is boiled for two minutes, washed, and dried in the sun. The colour thus obtained possesses a great degree of durability. It is of a deeper brown by the omission of the alum and vinegar in the mordant; and after these colours the lighter shades are dyed. Sumach may be employed as a substitute for

Puce co-
lour.

Compound half of the madder. Different brown colours, possessing considerable permanency, may likewise be produced by the use of Brazil and logwood, if more or less of a solution of iron be mixed with a decoction of these substances. The wool being previously alumed and galled, is dyed in it.

Purple
violet.

II.—Of dyeing Silk with Mixtures of Black, &c.

M. Gubliche imparts to silk a purple violet without a blue ground, with a mixture of one part of galls dissolved in white wine, with three parts of water, in which a pound of silk is macerated for twelve hours, soaked in a mordant made up of two ounces of alum, one ounce of solution of tin, and half an ounce of muriatic acid. After wringing the stuff, it is dyed in a bath composed of two ounces of cochineal and a small quantity of solution of iron, till the intended shade has been communicated; and for shades which are lighter, the residua of these baths are sufficient, either separately or mixed together. Madder may be used in the same way, macerating a pound of silk in a solution of alum mixed with an ounce of muriatic acid and a quantity of solution of iron. When the stuff is wrung out, it is dyed in a bath made of eight ounces of madder. When deeper colours are wanted, some of the solution of galls in white wine is mixed with the madder and cochineal baths.

Silk may be dyed in a bath made of equal parts of Brazil and logwood juice, adding a certain quantity of solution of iron after the stuff has been soaked in a solution of two ounces of alum and an ounce of muriatic acid. If solution of galls be added, the colour becomes deeper.

Brick
colour.

Colours resembling that of brick may be produced by immersing silk in an anotta bath, after preparing it with a solution of galls mixed with a certain quantity of solution of iron. By the mixture of Brazil, logwood, archil, and galls, and by a browning with sulphate of iron, a number of different shades are produced; but the whole of them have more or less a tendency to fade, although their brightness is very pleasing to the eye.

III.—Of dyeing Cotton and Linen with Mixtures of Black, &c.

With black
cask.

A permanent violet colour may be given to thread and cotton, when scoured in the ordinary way, by preparing a mordant with two quarts of the bath of what is called the *black cask*, and four quarts of water, for each pound of stuff, which is made to boil, and the scum is removed which forms on the surface, till it wholly disappears. The liquor is poured into a vat, and, when warm, four ounces of sulphate of copper and one ounce of nitre are dissolved in it. The skeins are left to soak in it for ten or twelve hours, wrung out, and dried. If it is required to produce a deep violet colour, two ounces of verdigris must be added to the bath; and if the nitre be omitted, the colour becomes still deeper by galling the thread more or less prior to its being put into the mordant. If the nitre be increased, and the sulphate of copper be diminished, the violet colour becomes more inclined to lilac. A number of various shades may be produced by different modifications of the mordants employed.

Marone
colour.

Cotton is galled, dipped, and wrought in the common way, when different shades of marone colour are wanted. To the bath employed must be added more or less of the liquor of the black cask. The cotton is then washed in a bath mixed with verdigris, next welded, and dyed to a fustic bath, to which a solution of soda and alum is sometimes added. When the cotton prepared in this manner has been thoroughly washed, it is next well maddered,

dipped in a weak solution of sulphate of copper, and last of all in soap suds.

Calico-
Printing.
Hazel.

For some hazel and snuff colours, a browning is communicated to stuffs by means of soot, after the welding and madder bath, to which galls and fustic have been added; sometimes soot is mixed with this bath, and a browning is likewise imparted by means of a solution of sulphate of iron; and for browning colours, walnut peels are sometimes employed as a substitute for solutions of iron. For such wools as are designed for the manufacture of tapestry they are very advantageous, because the colour is not changed into yellow by exposure to the air, as is the case in browning, which is imparted by means of iron, but remains a considerable time without any sensible change. The hue is indeed rather dull, but its goodness and very moderate price are sufficient to recommend a more extensive use of it for grave colours, which in common stuffs are sometimes fashionable.

CHAPTER VI.

OF CALICO-PRINTING.

Calico-printing is the art of communicating different colours to particular parts of the surface of cotton or linen cloth, while the rest of the cloth retains its white colour; or the whole of the cloth may be dyed one colour, as red or blue, except particular parts, to which some other colours, as yellow, orange, green, &c. are given. The process is not confined to linen and cotton cloth; it may be applied also to silk and woollen cloth; but as the nature of the processes is in all cases the same, it will answer our purpose sufficiently if we give a sketch of the methods followed by the *calico-printers*.

There is a curious passage in Pliny's Natural History, from which it is evident that calico-printing in his time (the first century) was understood and practised in Egypt. The following is a translation of this passage.

"There exists in Egypt a wonderful method of dyeing. Practised by the ancients. The white cloth is stained in various places, not with dyes, but with substances which have the property of absorbing (*fixing*) colours. These applications are not visible upon the cloth; but when the pieces are dipt into a hot caldron containing the dye, they are drawn out an instant after dyed. The remarkable circumstance is, that though there be only one dye in the vat, yet different colours appear on the cloth; nor can the colours be afterwards removed."¹ It is evident enough that the substances employed to stain the cloth, as Pliny expresses it, were different mordants, which served to fix the dye upon the cloth. Thus if we suppose certain parts of a piece of cotton cloth to be impregnated with alumina, and the cloth afterwards dyed with madder, after the clearing, those parts only impregnated with the mordant would retain their red colour, while the remaining parts will continue white.

The general opinion is, that this ingenious art originated in India, and from that country made its way into Egypt. Whether this notion be well or ill founded, it is certain that calico-printing was known and executed by the Indians at a very early period. Their colours were beautiful and fast, and the varieties of pattern and the number of colours which they understood to fix on different parts of the cloth gave to their printed calicoes a beauty and a value of no ordinary kind; but their processes are so tedious and so clumsy that they could be put in practice only where labour was exceedingly cheap.

¹ Plinii Hist. Nat. xxxv. 11.

Calico-
Printing.
Introdu-
ced into
Europe.

It is not more than a century and a half since calico-printing was transferred from India to Europe, and little more than a century since it became common in Great Britain. The nations with whom it has made the greatest progress are Switzerland; France, especially in Alsace; some parts of Germany; and Great Britain. In Europe the art has been in a great measure created anew. By the application of machinery, and by the light thrown on the processes by the improvements in chemistry, the tedious methods of the Indians have been wonderfully simplified; and the processes are remarkable for the rapidity with which they are executed, and for the beauty and fastness and variety of the colours which are applied on the surface of cotton and linen cloth.

We shall endeavour in this chapter to give a sketch of the different processes of calico-printing, such as they are at present practised by the most scientific printers in Lancashire, and in the neighbourhood of Glasgow.

The different processes to which the cotton cloth destined to be printed is subjected, are the following: singeing, bleaching, callendering, printing, stoving, dunging, dyeing, brightening.

1. The singeing is intended to remove the fibres of cotton which protrude on the surface of the cloth. This is done by passing the cloth rapidly over the surface of a red-hot iron plate, which burns off all the hairs or protruding fibres of cotton without injuring the cloth. Of late years singeing has been effected by a very ingenious coal gas apparatus. But we need not dwell upon this preliminary process, because the *singeing* has been described already in this Encyclopædia under the article BLEACHING, to which we refer the reader.

2. The methods of *bleaching* and *callendering* cotton have been already given at sufficient length under the article BLEACHING.

3. There are two modes of printing; namely, *block-printing* and *cylinder-printing*. The former has been practised from time immemorial; the latter is a modern invention, and originated probably after the introduction of the art of printing into Great Britain. The figure intended to be communicated to the cloth is cut out upon a block of sycamore, the parts which are to make the impression being left prominent, and the rest of the block cut away, just as practised for wooden engravings. When the figure is too complicated, and the lines too fine, to admit of being cut in wood, it is made by means of small pieces of copper, which are very ingeniously driven into the block, and the intervals are filled up with felt. Great patience and ingenuity are displayed in making these blocks for use, and calico-printers are under the necessity of keeping a number of workmen at high wages for that express purpose.

The cylinder is a large circular copper plate, being a circular ruler, several feet long, and several inches in diameter, upon which the different figures to be given to the cloth are engraved; and by its circular motion the whole of these figures are impressed upon the cloth as it moves through under the cylinder. But the usual method of cylinder-printing is to have the intended figures engraven upon a flat copper plate about a square yard (or more) in size. Upon this plate the colour to be applied is spread. It is then pulled. As it passes along, an elastic steel plate called a *doctor* takes off all the colour except that which fills the engraving. It is then pressed against the white cloth, on which it thus leaves exactly the impression of the engraving. This is a very common method of printing pocket handkerchiefs.

Whether the printing is applied by the block, the cylinder, or by flat copper plates, the treatment of the goods is nearly the same.

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Printing.

Most commonly the printing process is applied to fixing mordants on the cloth, which is afterwards dyed in the common way, those parts only retaining the colour which have imbibed the mordant, while the other parts of the cloth remain white. Sometimes it is applied to cloth already dyed, in order to remove the colour from certain portions of it which are either intended to remain white, or to receive some other colour afterwards.

Sometimes it is applied to cloth before it is dyed blue, in order to prevent the indigo from being fixed on those parts to which it is applied, that they may remain white, or be afterwards made to receive other colours. Substances possessed of this property are called resist pastes.

Finally, it is frequently employed to communicate mordants and colouring matter at once to the cloth. Let us take a view of all these different uses.

I.—Mordants.

The principal mordants employed by the calico-printers are the following:

1. *Alumina*.—The usual aluminous mordant of the calico-printers is alum, partly decomposed by acetate of lime. The liquid is made by dissolving alum in water, and adding acetate of lime to the solution. The liquid has a specific gravity of 1.08, and contains about as much alum undecomposed as the liquid can hold in solution.

For particular purposes calico-printers make a mordant by mixing three parts of acetate of lead with four of alum. This mordant consists of a mixture of acetate of alumina and alum, for about a third part of the alum remains undecomposed.

When cloth to be dyed *red* is impregnated with this mordant, it is not thickened. When applied only to particular parts of the cloth by the block or the cylinder, it is thickened with flour or calcined starch, or gum senegal, according to the nature of the style of work.

2. *Oxide of tin*.—Perchloride of tin is very much used as a mordant. The colouring matter is previously mixed with it, and both are applied at once. Such applications are called *chemical colours*. The mixture is allowed to dry on the cloth, which is then merely washed with water. Colours so applied are easily altered by light, soap, &c. Hence, in common language, a *chemical colour* means a fugitive colour. The colours produced in this way are, *pink*, from Brazil wood, peach wood, and cochineal; *purple*, from logwood; and *yellow*, with Persian berries.

Perchloride of tin is much used in another and pretty common process of the calico-printers, known technically by the appellation of *steam colours*. It is decomposed and converted into stannate of potash. The whole piece of cloth is immersed in the liquid containing the stannate of potash, and dried. The peroxide of tin is then precipitated upon the cloth, by immersing it into a solution of sal ammoniac or sulphate of magnesia, but most commonly into a very weak solution of free sulphuric acid. The different colouring matters previously thickened with starch are then printed on the cloth, and the whole subjected to the action of steam. The consequence is, that by the joint action of moisture and heat, a combination takes place between the colouring matter and the oxide, which is thus rendered insoluble; and no considerable quantity of water is ever present to carry off the colouring matter before it has combined with the mordant.

In this way *pink*, *purple*, and *yellow* are obtained of every variety of shade that can be produced by mixture of these colours with each other, or with Prussian blue.

3. *Peroxide of iron*.—This metallic oxide is much used as a mordant. It is employed in the state of acetated protoxide of iron, by dissolving metallic iron in pyrolignic

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acid.¹ In a few days after being applied to the cloth, especially if exposed to a moist atmosphere, it loses its acid, and the iron becomes peroxidized.

Acetate of iron, of specific gravity 1.05, gives a black with madder. Various shades of purple are obtained by adding different proportions of the mordant and dyestuff. Various shades of red, from brown red to pink, are obtained in the same way, substituting the aluminous mordant of various strengths for the iron. *Chocolates* are got by mixing the aluminous and iron mordants, and then dyeing with madder.

These are the principal mordants employed by the calico-printers. Several substances have so strong an affinity for the cloth that they require no mordant. This is the case with *indigo*, *sesquioxide of manganese*, *peroxide of iron*, and *chromate and dichromate of lead*.

II.—Substances used for discharging Colours.

Most colours are fixed in the cloth, either by means of mordants or by being in a particular state of oxidizement. Thus madder is fixed by means of alumina, and cochineal by means of oxide of tin. Sesquioxide of manganese loses its fixity and is washed away by water the moment that it is converted into protoxide. Hence, when the printers wish to discharge a colour from cloth, they employ something that will dissolve the mordant, or, if no mordant be present, will de-oxidize the colouring matter, which in that case is a metallic oxide. The *dischargers*, then, are either acids, or substances having a strong affinity for oxygen. We shall point out the chief of these, and the way of applying them.

Method of
using.

1. *Citric acid* is much used by printers to dissolve alumina and peroxide of iron, and thus to prevent the colours which these mordants would fix from remaining on the cloth. It is obtained by evaporating lemon juice, and thickening it with gum-senegal for the cylinder, or with gum and pipe-clay for the block. It is occasionally assisted by bisulphate of potash or sulphuric acid.

Sometimes the citric acid is printed on white cloth, and the aluminous or iron mordant slightly thickened and dried immediately, to prevent the swelling of the acid figures. At other times the mordants are first applied, and the acids printed over them.

In both cases the goods are afterwards passed through hot water containing cow's dung, and well washed before drying. By this means all the mordant is removed from those parts on which the acid was applied, which of course remains white when the cloth is dyed.

2. *Tartaric acid* thickened with gum is applied by the block or cylinder to cloth previously dyed Turkey red. It is then passed through an aqueous solution of bleaching powder. The acid disengaging the chlorine, the red colour is discharged from those places to which it had been applied, while all the other parts of the cloth retain their red colour.

When oxide of lead is deposited on the cloth along with the acid, and the cloth, after passing through the aqueous solution of bleaching powder, is made to pass through water impregnated with bichromate of potash, the parts which would otherwise have become white are changed into a fine yellow. This beautiful process is not confined to Turkey red.

To dis-
charge
manga-
nese.

3. *Protochloride of iron* is used to discharge the manganese brown and substitute a buff. This it does by depriving the manganese of its oxygen, and thus rendering it soluble; while the protochloride of iron converted into

perchloride deposits peroxide of iron on the cloth, which combines and produces the characteristic buff or orange colour of that oxide.

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Sulphate of iron is used in a variety of ways. It de-oxidizes indigo in the indigo vat, and renders it soluble in lime water. It produces gold, buff, &c. colours, and makes a good chemical black with logwood.

4. *Protochloride of tin*, when applied to cloth dyed brown by sesquioxide of manganese, immediately reduces it to the state of protoxide, and thus discharges the colour and leaves the parts white. If it be mixed with Brazil wood or cochineal, it discharges the manganese as before, but leaves a pink. When mixed with logwood it leaves a purple, and when with Prussian blue, a blue.

To produce a yellow upon manganese, ground chloride of tin is mixed with sulphate of lead. The mixture thickened with calcined starch is printed on the manganese brown. As soon as it is dry, the manganese being reduced to the state of protoxide, may be washed off; but the sulphate of lead adheres to the cloth, from an affinity which exists between them. The cloth being now passed through a solution of bichromate of potash, those parts containing the sulphate of lead are dyed a beautiful yellow by the formation of chromate of lead.

Chloride of tin is capable also of removing peroxide of iron from cloth, by reducing it to protoxide, as it does the sesquioxide of manganese. For this purpose it is printed on a deep colour, composed of peroxide of iron and quercitron yellow. The protochloride of iron is formed and washed away, while the oxide of tin remaining, constitutes a mordant for the quercitron. And thus the parts to which the protochloride of tin was applied become yellow.

The protochloride of tin is also employed occasionally to discharge the orange, consisting of dichromate of lead fixed upon cloth. This it does by reducing the chromic acid to protoxide. As the green oxide of chrome still continues attached to the cloth, the discharged parts do not assume a good white colour. But this does not much affect the blue and purple colours substituted for the orange, by mixing the protochloride of tin with Prussian blue or with logwood.

When protochloride of tin is decomposed by carbonate of soda, protoxide of tin is obtained. This protoxide is used along with potash to render indigo soluble. The protoxide de-oxidizes the indigo, and the potash dissolves the yellow base. It is then applied to the cloth in the way that will be explained afterwards.

III.—Resist Pastes.

These pastes are substances which have the property of restoring the blue colour to dissolved indigo, and thus of preventing it from being fixed to those parts of the cloth on which the resist pastes have been applied. Any substance which has the property of parting with oxygen readily answers this purpose. Thus sulphate of copper, or any salt containing black oxide of copper, when put into the indigo vat, instantly revives the indigo, by communicating oxygen to it. The hydrated black oxide has the same effect, and so have the sesquioxide and the deut-oxide of manganese.

The calico-printer's indigo vat is a very deep large vessel filled with water, into which indigo, sulphate of iron, and an excess of lime are put. The lime decomposes the sulphate of iron, and the protoxide of iron thus disengaged coming in contact with the indigo at the bottom of the

Nature of
resist
pastes.

¹ An impure acetic acid, obtained by distilling wood.

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Printing.Calico-
Printing.

vat, deprives it of an atom of oxygen, and thus renders it capable of combining with the lime, and of forming a compound which dissolves in water and forms a yellowish-coloured solution. Where this solution is in contact with the atmosphere the indigo is revived, assumes its blue colour, and loses its solubility. Hence the blue scum which always covers the surface; but this scum in some measure protects the rest of the vat. When cloth is dipped into this vat it comes out yellow; but the indigo, from its exposure to the air, gradually absorbs oxygen, so that the cloth becomes at first green, and finally blue. But if to any parts of the cloth before dipping something has been applied which has the property of giving out oxygen to the indigo, all the indigo which would have been imbibed by these parts has been revived before it has had time to come in contact with the cloth; and in the blue state it has not the property of uniting with the cloth, but may be easily washed off. Hence the parts to which the *resist pastes*, as they are called, have been applied, remain white. The principal resist pastes are the following:

Enumera-
tion.

1. *Blue paste*, or *vitriol paste*, consists of a mixture of sulphate and acetate of copper, and the solution is thickened with gum-senegal and pipe-clay for the block, and with flour for the cylinder. When the cloth on which this paste has been printed is dipped into the indigo vat, the indigo is oxidized before it reaches the surface of the cloth. After dyeing, the piece is passed through weak sulphuric acid, to remove the oxide of copper which has been precipitated.

2. *Mild paste* consists of sulphate of zinc, gum, and pipe-clay. It is used along with other colours which copper would injure, or which would be destroyed by immersion in sulphuric acid. It resists a pale blue, and the removal of the oxide of zinc afterwards by an acid is not necessary, as when copper is employed.

Sulphate of zinc, as well as all the other metallic salts, and all the acids, precipitate indigo from its solution in lime. It does not revive indigo like the salts of copper; but when the base of indigo is precipitated, it is not so readily fixed as when in a state of solution. The oxide of zinc, with the gum and pipe-clay, act mechanically in keeping it at a distance.

3. *Red paste* consists of the aluminous mordant already described, mixed with acetate of copper, gum, and pipe-clay. It resists pale blues; and the alumina remains upon the portions which are white, to be afterwards dyed with madder and produce a red, or with quercitron for a yellow.

4. *Neutral paste* is the name given by calico-printers to a compound of lime juice, sulphate of copper, gum, and pipe-clay. It resists during a short dip in the blue vat; and the lime juice gives it the property of remaining white when the piece is dyed in madder, even where the preceding aluminous paste goes over it. This acid also prevents the lime of the blue vat from precipitating copper upon the cloth, which would give the cloth a deep-brown tinge in the madder vessel.

5. *Chrome yellow resist paste* consists of a mixture of a salt of copper to resist the blue vat, with a salt of lead to produce a yellow with bichromate of potash after having been dyed blue in the blue vat.

These five constitute the principal resist pastes. There are indeed a few others, but they are of little importance, and they will easily suggest themselves to those who understand the principles of chemistry.

Methods
of giving
the various
colours.

Instead of describing the mode of printing mordants and colouring matters at once, or of applying *chemical colours*, as they are called, we think it will be better to make a few observations on each particular colour in succession,

without minding whether it be applied by *dyeing* or *printing*.

1. *Red.*

The usual dyestuff for red among the calico-printers is *madder*. Goods which have received the aluminous mordant applied in figures either by the cylinder or the block, are first passed through hot water containing cow-dung, and well washed. They are then put into a dye vessel along with madder and cold water, to which heat is gradually applied either by means of steam or fire. The pieces are kept constantly moving in the vessel till they have gained the requisite depth of shade, when they are taken out and washed again. The colour given by the madder to those parts of the cloth which have received no mordant, is removed by boiling the cloth in water containing either bran or soap, both of which substances have the property of removing it without injury to the red figure. Afterwards the white portion of the cloth is farther improved by rinsing it in a weak warm solution of bleaching powder.

When *Brazil* wood or *peach* wood is used instead of madder, the mordant and method of dyeing are the same. The cloth, however, does not bear the same treatment after dyeing, and does not require it, because these colours are much more easily removed from the parts of the cloth destitute of mordant.

2. *Pink.*

The most beautiful *pink* to be seen on calico is given by means of cochineal. The mordant is alumina, and the method of proceeding similar to that already described. Madder, when mixed with bran to remove the brown colouring matter, gives what is called a *brown pink*.

Safflower cannot be applied to cloth in figures, but it is frequently employed for giving a uniform pink dye to pieces of cloth. It is first steeped in water containing a carbonated alkali, which dissolves its colouring matter. The solution freed from the fibrous part of the dyestuff is then saturated by an acid, which is commonly *lime juice*. A piece of cloth immersed in this saturated solution extracts the pink colouring matter from it, which is afterwards heightened by immersion in weak cream of tartar. By this means a very beautiful but fugitive colour is communicated.

3. *Yellow.*

The most usual substance now employed by the calico-printers for communicating this colour is *chromate of lead*. The use of this very beautiful and fixed colour does not go farther back than ten or twelve years. The writer of this article endeavoured about fourteen years ago to prevail upon some of the calico-printers in the neighbourhood of Glasgow to try it, but unsuccessfully. At last, after much entreaty, Mr Ramsay, at that time an extensive manufacturer of colours for calico-printers, was induced to make a small quantity of bichromate of potash, so as to put it in the power of those who chose it to try how it would answer. Soon afterwards the use of it was introduced into some of the printing works of France. From that country it soon made its way to Lancashire, and thence to Glasgow. The bichromate of potash, when first prepared, sold as high as a guinea per pound. Of late years it has been as low as tenpence. The method of using this beautiful dyestuff is this:

Acetate or nitrate of lead is applied to the cloth, either by means of the block or cylinder. The cloth is either immediately passed through a solution of bichromate of potash, or the oxide of lead is in the first place set free from its acid by immersing the cloth in lime water, or

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Printing.

in some cases into an aqueous solution of bleaching powder. Indeed the processes for applying chromic acid are varied in a great many ways, to suit the different colours which are applied along with the yellow; as in the yellow discharge for bronze, and the yellow resist on blue already described, the yellow discharge on Turkey red, &c. &c.

Quercitron bark is also often employed to communicate a yellow by the calico-printers. The alumina mordant is first applied, and the cloth is cleaned in the dung vessel in the way described when giving an account of madder dyeing. *Quercitron bark* gives out its colouring matter at a lower heat than madder; and the parts of the cloth to which no mordant has been applied remain tolerably white after the cloth has been washed in cold water.

A decoction of Persian berries constitutes likewise a common yellow dyestuff for calico-printers. The decoction is mixed with the requisite portion of alum to act as a mordant; but a combination between the alumina and the yellow colouring matter takes place without the intervention of a third agent. It is effected either by exposing the cloth to the action of steam, or by putting the piece into water containing an alkali or its carbonate.

4. Blue.

The usual dyestuffs for giving a blue colour to calicoes are *indigo* and *Prussian blue*.

The method of forming the indigo vat has been already mentioned. The cloth is dipped in the clear solution. When taken out it is yellow, and gradually becomes blue by absorbing oxygen from the atmosphere. If a deep shade is wanted, the cloth is immersed again, when it receives an additional quantity of indigo, which must be oxidized, as the former was, by exposure to the air. These alternate dips and airings are repeated till the requisite shade is attained.

What is called *pencil blue*, is a solution of indigo in caustic potash or soda, the indigo being de-oxidized by means of orpiment. The solution is thickened by means of British gum, or gum-senegal, and printed upon the cloth either by the block or cylinder. When upon the cloth, the indigo attracts oxygen from the air, and thus becomes blue and fixed. The gum, alkali, loose indigo, &c. are washed away in water.

Prussian blue may be applied to cloth in various ways. We shall mention some of the principal of these.

1. An iron mordant is first applied to the cloth, and allowed to remain untouched till the iron has had time to be peroxidized, and in that way become fixed. The piece is then cleaned as for dyeing, and dipped into a solution of prussiate of potash mixed with sulphuric acid, to disengage the acid or cyanogen which it contains.

2. Prussian blue is dissolved in muriatic acid, oxalic acid, perchloride of tin, or nitrate of iron, and the solution applied immediately to the cloth in the usual way.

3. Ferrocyanic acid is printed upon the cloth, and decomposed by means of a steam heat, hydrocyanic acid escapes, and cyanodide of iron remains in the cloth. It becomes blue by exposure to the air, or by being put into a weak solution of bleaching powder, or of bichromate of potash.

Logwood forms a bluish compound with the salts of copper; but this colour is exceedingly fugitive, and the use of it has been long laid aside.

5. Black.

Various methods are employed by the calico-printers to produce a black upon cotton. An iron mordant of the specific gravity 1.05 gives a black with madder. The

common aluminous mordant gives a black when cloth impregnated with it is dyed in logwood. A chemical black is made from a decoction of nutgalls mixed with nitrated peroxide of iron. Another chemical black is formed by mixing a decoction of logwood with a solution of sulphate of iron.

If cloth be dyed successively *blue*, *red*, and *yellow*, it becomes *black*.

6. Buff.

To produce this colour, the cloth is printed with a mixture of sulphate and acetate of iron. After having had time to be partly peroxidized and partially decomposed, it is washed in water; or if a stronger buff is wanted, it is rinsed in cream of lime till the protoxide is converted into the red. No mordant is required, as the peroxide of iron has a strong affinity for cotton cloth.

7. Gold.

For this colour the process is the same as for buff. The only difference is, that the solution is stronger.

8. Orange.

The most beautiful orange is given by means of dichromate of lead. It is obtained by saturating bichromate of potash with potash or lime, and immersing in it while hot, cloth printed with a salt of lead. Nitric acid changes this orange into yellow, by uniting with half the oxide of lead.

9. Green.

The fast green, discovered by Mr James Thomson of Primrosehill, near Clitheroe, and commonly known by the name of *Warwick's green*, is a mixture of the pencil blue already described, and aluminated potash. The mixture is thickened and applied as the blue is. The alumina is then precipitated from its alkaline solution by being passed through a weak solution of sal ammoniac or sulphate of magnesia. The cloth is then dyed yellow in quercitron bark. It is sufficiently known that the two colours blue and yellow form a green.

Carbonate of copper makes a poor faint green upon cloth, while the hydrated black oxide forms a bright blue. It is obtained by printing on a strong solution of copper, and dipping the cloth, when dry, into strong caustic potash or soda.

The colour called *Scheele's green* is a mixture of arsenite of copper and the hydrated black oxide. It is obtained by printing on the cloth a strong solution of copper thickened with gum, and then dipping it into a mixture of arsenite of potash and caustic potash. Hot water destroys this colour, by depriving the oxide of copper of its water.

A green is obtained from Prussian blue and yellow berries, by mixing together ferrocyanic acid, yellow berries, and an aluminous mordant, and subjecting them to the action of steam.

Various other greens are attained by printing yellows over blues previously produced.

Saxon green is produced by printing a solution of cerulin over a yellow formed by dyeing the aluminous mordant with quercitron bark or weld. The cerulin adheres to those parts of the cloth which have been dyed yellow, but very slightly to the white cloth, from which it is easily washed away.

10. Lilac.

This colour is communicated to cloth by printing on a much diluted mixture of the iron and aluminous mordants thickened with gum-senegal. The cloth is then dyed in madder exactly as described for producing a red.

Calico-
Printing.

Dyer.

11. *Chocolate.*

The same mordants, but much stronger, and dyeing in madder in the same way, produces this colour.

12. *Purple.*

The iron mordant, diluted to the shade required, is printed on the cloth, which is then dyed in madder in the usual way.

When the cloth, after a weak aluminous mordant has been printed on it, is dyed in logwood, a *purple* colour is obtained.

13. *Brown.*

By far the finest and most fixed brown is communicated to cotton by means of the sesquioxide of manganese. The process is rather a recent one, but of late years it has become very general. A neutral solution of sulphate of manganese is thickened with gum, and printed on the cloth. It is then dipped into rather strong caustic potash ley, which precipitates the protoxide of manganese. By exposure to the air, or by immersion in bleaching powder solution, or in bichromate of potash, this protoxide absorbs more oxygen, and becomes fixed on the cloth. Though the state of oxidizement has not been determined by experiment, yet it is probable that the manganese is in the state of red oxide, which is a compound of two atoms sesquioxide and one atom protoxide.

Dyer.

14. *Drab.*

This is made by printing on an iron mordant, and then dyeing in quercitron bark.

15. *Olive.*

Formed by printing on a mixture of the iron and aluminous mordants, and dyeing in quercitron bark.

16. *Dove.*

A weak iron mordant dyed in cochineal.

17. *Slate.*

A weak iron mordant dyed in nutgalls or in sumach.

18. *Cinnamon.*

The aluminous mordant, with the addition of a little iron, dyed in a mixture of madder and quercitron bark.

Such are the principal colours given to calicoes, and such are the methods of applying and fixing them.

We have now finished our account of calico-printing; for the dunging and brightening processes have been described while treating of the various colours; and the *storing*, which consists simply in drying the goods in a room raised by artificial heat to a temperature higher than the boiling point of water, requires no description.

(L.)

DYER, SIR JAMES, an eminent English lawyer, chief judge of the court of common pleas in the reign of Queen Elizabeth. He died in 1581; and about twenty years afterwards was published his large collection of Reports, which have been highly esteemed for their succinctness and solidity. He also left other writings behind him relative to his profession.

DYER, *John*, the son of Robert Dyer, a Welsh solicitor of great capacity, was born in 1700. He passed through Westminster school under the care of Dr Freind, and was then called home to be instructed in his father's profession. His genius, however, led him a different way; for besides his early taste for poetry, he had a passion no less strong for the arts of design, and determined to make painting his profession. With this view, having studied some time under a master, he became, as he tells his friend, an itinerant painter, and wandered about South Wales and the parts adjacent. About 1727 he printed *Grongar Hill*. Being probably dissatisfied with his own proficiency, he made the tour of Italy, where, besides the usual study of the remains of antiquity, and the works of the great masters, he frequently spent whole days in the country about Rome and Florence, sketching those picturesque prospects with facility and spirit. Images drawn from thence naturally transferred themselves into his poetical compositions; the principal beauties of *The Ruins of Rome* are perhaps of this kind; and the various landscapes in *The Fleece* have been particularly admired. On his return to England he published *The Ruins of Rome*, 1740; but soon found that he could not relish a town life, nor submit to the assiduity required in his profession. As his turn of mind was rather serious, and his conduct and behaviour were always irreproachable, he was advised by his friends to enter into holy orders; and it is presumed, though his education had not been regular, that he found no difficulty in obtaining them. He was ordained by the

Bishop of Lincoln, and had a law degree conferred on him.

About the same time he married a lady of Coleshill, named Ensor, "whose grandmother," says he, "was a Shakspeare, descended from a brother of every body's Shakspeare." His ecclesiastical provision was a long time but slender. His first patron, Mr Harper, gave him, in 1741, Calthorpe, in Leicestershire, of L.80 a year, on which he lived ten years; and in April 1751 he exchanged it for Belchford, in Lincolnshire, of L.75, which was given him by Lord Chancellor Hardwicke, on the recommendation of a friend to virtue and the muses. His condition now began to mend. In 1752 Sir John Heathcoate gave him Coningsby, of L.140 a year, and, in 1756, when he was created LL.B. without any solicitation of his own, obtained for him from the chancellor, Kirby-on-Bane, of L.110. In 1757 he published *The Fleece*, his greatest poetical work, of which Dr Johnson relates this ludicrous story. Dodsley the bookseller was one day mentioning it to a critical visitor, with more expectation of success than the other could easily admit. In the conversation the author's age was asked; and being represented as advanced in life, "He will," said the critic, "be buried in woollen." He did not indeed long outlive that publication, nor enjoy the increase of his preferments; for a consumptive disorder, with which he had long struggled, carried him off at length in 1758.

Mr Dyer's character as a writer has been fixed by three poems, *Grongar Hill*, *The Ruins of Rome*, and *The Fleece*; in which a poetical imagination perfectly original, a natural simplicity connected with, and often productive of the true sublime, and the warmest sentiments of benevolence and virtue, have been universally observed and admired. These pieces were published separately in his lifetime; but after his death were collected and published in one volume 8vo, 1761, with a short account of himself prefixed.

DYNAMICS.

Dynamics. 1. THIS name marks that department of physico-mathematical science which contains the abstract doctrine of *moving forces*; that is, whatever necessarily results from the relations of our ideas of motion, and of the immediate causes of its production and changes.

Definition. 2. All *changes* of motion are considered by us as the indications, the characteristics, and the measures of changing causes. This is a physical law of human thought, and therefore a principle to which we may refer, and from which we must derive all our knowledge of those causes. When we appeal to our own thoughts or feelings, we do not find in ourselves any disposition to refer mere existence to any cause, although the beginning of existence certainly produces this reference in an instant. Had we always observed the universe in motion, it does not appear that we should have ascribed it to a cause, till the observation of relative rest, or something leading to it, had enabled us to separate, by abstraction, the notion of matter from that of motion. We might then perceive that rest is not incompatible with matter; and we might even observe, by means of relative motions, that absolute rest might be produced by the concurrence of equal and opposite motions. But all this requires reflection and reasoning, whereas we are now speaking of the first suggestions of our minds.

3. We cannot have any notion of motion *in abstracto*, without considering it as a state or condition of existence which would remain if not changed by some cause. It is from changes alone, therefore, that we infer any agency in nature; and it is in these that we are to find all that we know of their causes.

Mechanical relation, what. 4. When we look around us, we cannot but observe that the motions of bodies have in most cases, if not always, some relation to the situation, the distance, and the discriminating qualities of other bodies. The motions of the moon have a palpable relation to the earth; the motions of the tides have as evident a relation to the moon; the motions of a piece of iron have a palpable dependence on a magnet. The vicinity of the one seems to be the occasion at least of the motions of the other. The causes of these motions have an evident connection with or dependence on the other body. We are even disposed to imagine that they are inherent in that body, and that it possesses certain qualities which are the causes of those modifications of motion in other bodies. These serve to distinguish some bodies from others, and may therefore be called *properties*; and since the condition of other bodies so evidently depends on them, these properties express very interesting relations of bodies, and are chiefly attended to in the enumeration of the circumstances which ascertain what we call the *nature* of any thing. We do not mean to say that these inferences are always just; nay, we know that many of them are ill founded; but they are real, and they serve abundantly for informing us what we may expect from any proposed situation of things. It is enough for us to know, that when a piece of iron is so and so situated in relation to a magnet, it will move in a certain manner.

This mutual relation of bodies is differently considered, according to the interest that we chance to take in the phenomenon. The cause of the approach of the iron to a magnet is generally ascribed to the magnet, which is said to attract the iron, because we commonly employ the magnet in order that these motions may take place. The similar approach of a stone to the earth is ascribed to the stone, and we say that it tends to the earth. In all pro-

bability the procedure of nature is the same in both; for **Dynamics.** they are observed in every instance to be mutual between the related bodies. As iron approaches a magnet, so the magnet approaches the iron. The same thing is observed in the motions of electrified bodies; also in the case of the stone and the earth. Therefore the cause of the motions may be conceived as inherent in either, or in both.

The qualities thus inherent in bodies constituting their *Force* and mechanical relations, have been called the *mechanical af-* *Action* are *sections of matter*. But they are more commonly named *figurative powers* or *forces*; and the event which indicates their presence is considered as the effect and mark of their agency. *terms when used in mechanism.* The magnet is said to *act* on the iron, the earth is said to *act* on the stone; and the iron and the stone are said to *act* on the magnet and on the earth.

All this is figurative or metaphorical language. All languages have begun with social union, and have improved along with it. The first collections of words expressed the most familiar and the most interesting notions. In the process of social improvement, the number of words did not increase in the same proportion with the notions that became interesting and familiar in their turn: for it often happened that relations of certain ideas so much resembled the relations of certain other ideas, that the word expressing one of them served very well for expressing the other; because the dissimilar circumstances of the two cases prevented all chance of mistake. Thus we are said to *surmount* a difficulty, without attaching to the word the notion of *getting over* a steep hill. Languages are thus filled with figurative expressions.

5. *Power, Force, and Action*, are words which must have *But the* appeared in the language of the most simple people; because the notions of personal ability, strength, and exertion, *analogy is* are at once the most familiar and the most interesting that *not in the* can have a place in the human mind. These terms, when *force, but* used in their pure, primitive sense, express the notions of *in the effect.* the power, force, and action of a sentient, active being. Such a being only is an agent. The exertion of his power or force is (exclusively) action; but the relation of cause and effect so much resembles in its results the relation between this force and the work performed, that the same term may be very intelligibly employed for both. Perhaps the only case of pure unfigurative action is that of the mind on the body. But as this is always with the design of producing some change on external bodies, we think only of them; the instrument or tool is overlooked, and we say that we *act* on the external body. Our *real* action therefore is but the first movement in a long train of successive events, and is but the remote cause of the interesting event. The resemblance to such actions is very strong indeed in many cases of mechanical phenomena. A man throws a ball by the motion of his arm. A spring impels a ball in the same manner by unbending. These two events resemble each other in every circumstance but the action of the mind on the corporeal organ; the rest of it is a train of pure mechanism. In general, because the ultimate results of the mutual influence of bodies on each other greatly resemble the ultimate results of our actions on bodies, we have not invented appropriated terms, but have contented ourselves with those already employed for expressing our own actions, the exertions of our own powers or forces. The relation of physical cause and effect is expressed metaphorically in the words which belong properly to the relation of agent and action. This has been attended by the usual consequences of poverty

Dynamics. of language, namely, ambiguity, and sometimes mistake, both in our reflections (which are generally carried on by mental discourse), our reasonings, and our conclusions. It is necessary to be on our guard against such mistakes; for they frequently amount to the confounding of things totally different. Many philosophers of great reputation, on no better foundation than this metaphorical language, have confounded the relations of activity and of causation, and even denied that there is any difference; and they have affirmed that there is the same invariable relation between the determinations of the will and the inducements that prompt them, as there is between any physical power and its effect. Others have maintained that the first mover in the mechanical operations, and indeed through the whole train of any complicated event, is a percipient and intending principle, in the same manner as in our actions. According to these philosophers, a particle of gravitating matter perceives its relation to every other particle in the universe, and determines its own motion according to fixed laws, in exact conformity to its situation. But the language, and even the actions of all men, show that they have a notion of the relation of an agent to the action, easily distinguishable (because all distinguish it) from the relation between the physical cause and its effect. This metaphorical language has affected the doctrines of mechanical philosophy, and has produced a dispute about some of its first principles; the only way to decide this dispute is to avoid most scrupulously all metaphorical language, though at the expense of much circumlocution.

Directions for the safe employment of this analogy. 6. When we speak of powers or forces as residing in a body, and the effect as produced by their exertion, the body, considered as possessing the power, is said to *act* on the other. A magnet is said to act on a piece of iron; a billiard ball in motion is said to act on one that is hit by it; but if we attempt to fix our attention on this action, as distinct both from the agent and the thing acted on, we find no object of contemplation; the exertion or procedure of nature in producing the effect does not come under our view. When we *speak* of the action as distinct from the agent, we find that it is not the action, properly speaking, but the act, that we speak of. In like manner the action of a mechanical power can be conceived only in the effect produced.

Action implies change; and mere motion is not action. 7. A man is not said to act unless he produces some effect. Thought is the act of the thinking principle; motion of the limb is the act of the mind on it. In mechanics also, there is action only in so far as there is mechanical effect produced. I must act violently in order to begin motion on a slide. I must exert force, and this force exerted produces motion. I conceive the production of motion in all cases as the exertion of force; but it requires no exertion to continue the motion along the slide; I am conscious of none; therefore I ought to infer that no force is necessary for the continuation of any motion. The continuation of motion is not the production of any new effect, but the permanency of an effect already produced. We indeed consider motion as the effect of an action; but there would be no effect if the body were not moving. Motion is not the action, but the effect of the action.

Pression, impulsion. 8. Mechanical actions have been usually classed under two heads. They are either *pressions* or *impulsions*. They are generally considered as of different kinds—the exertions of different powers. *Pressure* is supposed to differ essentially from *impulse*.

Bad Instead of attempting to define, or describe, these two kinds of forces and actions, we shall just mention some instances. This will give us all the knowledge of their distinctions that we can acquire.

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When a ball lies on a table, and I press it gently on one side, it moves toward the other side of the table. If I follow it with my finger, continuing my pressure, it accelerates continually in its motion. In like manner, when I press on the handle of a common kitchen jack, the fly *begins* to move. If I continue to urge or press round the handle, the fly accelerates continually, and may be brought into a state of very rapid motion. These motions are the effects of genuine pressure. The ball would be urged along the table in the same manner, and with a motion continually accelerated, by the unbending of a spring. Also, a spring coiled up round the axis of the handle of the jack would, by uncoiling itself, urge round the fly with a motion accelerating in the same way. The more I reflect on the pressure of my finger on the ball, and compare it with the effect of the spring on it, the more clearly do I see the perfect similarity; and I call these influences, exertions, or actions, by one name, *pressure*, taken from the most familiar instance of them.

Again, the very same motion may be produced in the ball or fly, by pulling the ball or the machine by means of a thread, to which a weight is suspended. As both are motions accelerated in the same manner, I call the influence or action of the thread on the ball or machine by the same name, *pressure*, and *weight* is considered as a pressing power. Indeed I feel the same compression from the real pressure of a man on my shoulders that I would feel from a load laid on them. But the weight in our example is acting by the intervention of the thread. By its pressure it is pulling at that part of the thread to which it is fastened; this part is pulling at the next by means of the force of cohesion; and this pulls at a third, and so on, till the most remote pulls at the ball or the machine. Thus may elasticity, weight, cohesion, and other forces, perform the office of a genuine power; and since their result is always a motion beginning from nothing, and accelerating by perceptible degrees to any velocity, this resemblance makes us call them by one familiar name.

But further, I see that if the thread be cut, the weight will fall with an accelerated motion, which will increase to any degree, if the fall be great enough. I ascribe this also to a pressing power acting on the weight. Nay, after a very little refinement, I consider this power as the cause of the body's weight; which word is but a distinguishing name for this particular instance of pressing power. Gravitation is therefore added to the list of pressures; and for similar reasons the attractions and repulsions of magnets or electric bodies may be added to the list; for they produce actual compressions of bodies placed between them, and they produce motions gradually accelerated, precisely as gravitation does. Therefore all these powers may be distinguished by this descriptive name, *pressions*, which, in strict language, belongs to one of them only.

Several writers, however, subdivide this great class into Gravity, attractions, and repulsions. Gravity is a solicitation *extra*, by which a body is urged downward. In like manner the forces of magnetism and electricity, and a vast variety of other attractions and repulsions, are called *solicitations*. We see little use for this distinction, and the term is too like an affection of mind.

9. *Impulsion* is exhibited when a ball in motion puts another ball into motion by hitting, or (to speak metaphorically) by striking it. The appearances here are very different. The body that is struck acquires, in the instant of impulse, a sensible quantity of motion, and sometimes a very rapid motion. This motion is neither accelerated nor retarded after the stroke, unless it be affected by some other force. It is also remarked that the rapidity of the motion depends, *inter alia*, on the previous velocity of the striking body. For instance, if a clay ball,

Dynamics. moving with any velocity, strike another equal ball which is at rest, the struck ball moves with half the velocity of the other. And it is farther remarkable that the striking body always loses as much motion as the struck body gains. This universal and remarkable fact seems to have given rise to a confused or indistinct notion of a sort of transference of motion from one body to another. The phraseology in general use on this subject expresses this in the most precise terms. The one ball is not said to cause or produce motion in the other, but to *communicate* motion to it; and the whole phenomenon is called the *communication of motion*. We call this an *indistinct* notion; for surely no one will say that he has any clear conception of it. We can form the most distinct notion of the communication of heat, or of the cause of heat: of the communication of saltiness, sweetness, and a thousand other *things*; but we cannot conceive how part of that identical motion which was formerly in A, is now infused into B, being given up by A. It is in our attempt to form this notion that we find that motion is not a *thing*, not a substance which can exist independently, and is susceptible of actual transference. It appears in this case to be a state, or condition, or mode of existence, of which bodies are susceptible, which is producible, or (to speak without metaphor) causable, in bodies, and which is the effect and *characteristic* of certain natural qualities, properties, or powers. We are anxious to have our readers impressed with clear and precise notions on this subject, being confident that such, and only such, will carry them through some intricate paths of mechanical and philosophical research.

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10. The remarkable circumstance in this phenomenon is, that a rapid motion, which requires for the effecting it the action of a pressing power, continued for a sensible, and frequently a long time, seems to be affected in an instant by impulsion. This has tended much to support the notion of the actual transference of something formerly possessed exclusively by the striking body, inhering in it, but separable, and now transfused into the body stricken. And now room is found for the employment of metaphor, both in thought and language. The *striking* body affects the body which it thus impels: it therefore possesses the *power* of impulsion, that is, of *communicating* motion. It possesses it only while it is in motion. This *power*, therefore, is the efficient distinguishing cause of its motion, and its only office must be the continuation of this motion. It is therefore called the *inherent force*, the force inherent in a moving body, *VIS INSITA corpori moto*. This force is transfused into the body impelled; and therefore the transference is instantaneous, and the impelled body continues its motion till it is changed by some other action. All this is at first sight very plausible; but a scrupulous attention to those feelings which have given rise to this metaphorical conception should have produced very different notions. I am conscious of exertion in order to begin motion on a slide; but if the ice be very smooth, I am conscious of no exertion in order to slide along. My power is felt only while I am conscious of exerting it; therefore I have no primitive feeling or notion of power while I am sliding along. I am certain that no exertion of power is necessary here. Nay, I find that I cannot think of my moving forward without effort otherwise than as a certain mode of my existence. Yet we imagine that the partizans of this opinion did really deduce it in some shape from their feelings. We must continue the *exertion* of walking in order to walk on; our power of walking must be continually exerted, otherwise we shall stop. But this is a very imperfect, incomplete, and careless observation. Walking is much more than mere continuance in progressive motion. It is a continu-

ally repeated lifting our body up a small height, and allowing it to come down again. This renewed ascent requires repeated exertion.

11. We have other observations of importance yet to make on this force of moving bodies, but this is not the most proper occasion. Meanwhile we must remark, that the instantaneous production of rapid motion by impulse has induced the first mechanicians of Europe to maintain that the power or force of impulse is unsusceptible of any comparison with a pressing power. They have asserted that impulse is infinitely great when compared with pressure; not recollecting that they held them to be things totally disparate, that have no proportion more than weight and sweetness. But these gentlemen are perpetually enticed away from their creed by the similarity of the ultimate results of pressure and impulse. No person can find any difference between the motion of two balls moving equally swift, in the same direction, one of which is descending by gravity, and the other has derived its motion from a blow. This struggle of the mind to maintain its faith, and yet accommodate its doctrines to what we see, has occasioned some other curious forms of expression. Pressure is considered as an *effort* to produce motion. When a ball lies on a table, its weight, which they call a *power*, continually and repeatedly *endeavours* (mark the metaphorical word and thought) to move the ball downward. But these efforts are ineffectual. They say that this ineffectual power is *dead*, and call it a *vis mortua*: but the force of impulsion is called a *vis viva*, a living force. But this is very whimsical and very inaccurate. If the impelling ball falls perpendicularly on the other lying on the table, it will produce no motion, any more than gravity will; and if the table be annihilated, gravity becomes a *vis viva*.

We must now add, that in order to prove that impulse is infinitely greater than pressure, these mechanicians turn our attention to many familiar facts which plead strongly in their favour. A carpenter will drive a nail into a board with a very moderate blow of his hammer. This will require a pressure which seems many hundred times greater than the impelling effort of the carpenter. A very moderate blow will shiver into pieces a diamond which would carry the weight of a mountain. Seeing this prodigious superiority in the impulse, how shall they account for the production of motion by means of pressure; for this motion of the hammer might have been acquired by its falling from a height; nay, it is actually acquired by means of the continued pressure of the carpenter's arm. They consider it as the aggregate of an infinity of succeeding pressures in *every* instant of its continuance; so that the insignificant smallness of each effort is compensated by their inconceivable number.

On the whole, we do not think that there is clear evidence that there are two kinds of mechanical force essentially different in their nature. It is virtually given up by those who say that impulse is infinitely greater than pressure. Nor is there any considerable advantage to be obtained by arranging the phenomenon under those two heads. We may perhaps find some method of explaining satisfactorily the remarkable difference that is really observed in the two modes of producing motion; namely, the gradual production of motion by acknowledged pressure, and the instantaneous production of it by impulse. Indeed we should not have taken up so much of our readers' attention with this subject, had it not been for some inferences that have been made from these premises, which meet us in our very entry on the consideration of first principles, and that are of extensive influence on the whole science of mechanical philosophy, and, indeed, on the whole study of nature.

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Dynamics. 12. Mechanics are greatly divided in their opinion about the nature of the sole moving force in nature. Those whom we are now speaking of seem to think that all motion is produced by pressure; for when they consider impulse as equivalent to the aggregate of an infinity of repeated pressures, they undoubtedly suppose any pressure, however insignificant, as a moving force. But there is a party, both numerous and respectable, who maintain that impulsion is the sole cause of motion. We see bodies in motion, say they, and we see them impel others; and we see that this production of motion is regulated by such laws, that there is but one absolute quantity of motion in the universe which remains unalterably the same. It must therefore be transfused in the acts of collision. We also see, with clear evidence, in some cases, that motion can produce pressure. Euler adduces some very whimsical and complicated cases, in which an action precisely similar to pressure may be produced by motion. Thus, two balls connected by a thread may be so struck that they shall move forward, and at the same time wheel round. In this case the connecting thread will be stretched between them. Now, say the philosophers, since we see motion, and see that pressure may be produced by motion, it is preposterous to imagine that it is any thing else than a result of certain motions; and it is the business of a philosopher to inquire and discover what motions produce the pressures that we observe.

They then proceed to account for those pressing powers, or solicitations to motion, which we observe in the acceleration of falling bodies, the attractions of magnetism and electricity, and many other phenomena of this kind, where bodies are put in motion by the vicinity of other bodies, or, in the popular language, by the action of other bodies at a distance. To say that a magnet can act on a piece of remote iron, is to say that it can act *where* it is not, which is as absurd as to say that it can act *when* it is not. *Nihil movetur, says Euler, nisi a contiguo et moto.*

How does it produce pressure? The bulk of these philosophers are not very anxious about the way in which these motions are produced, nor do they fall upon such ingenious methods of producing pressure as the one already mentioned, which was adduced by Euler. The piece of iron, say they, is put in motion when brought into the neighbourhood of a magnet, because there is a stream of fluid issuing from one pole of the magnet, which circles round the magnet, and enters at the other pole. This stream impels the iron, and arranges it in certain determined positions, just as a stream of water would arrange the flote grass. In the same manner, there is a stream of fluid continually moving towards the centre of the earth, which impels all bodies in lines perpendicular to the surface; and so on with regard to other like phenomena. These motions are thus reduced to very simple cases by impulsion.

Incompatible with the rules of philosophy. It is unnecessary to refute this doctrine at present: it is enough that it is contrary to all the dictates of common sense. To suppose an agent that we do not see, and for whose existence we have not the smallest argument; with equal propriety we might suppose ministering spirits, or any thing that we please.

Others maintain that pressure is the sole moving force. 13. Other philosophers are so dissatisfied with this notion of the production of pressure, that they, on the other hand, affirm that pressure is the only moving force in nature; not according to the popular notion of pressure, by the mutual contact of solid bodies, but that kind of pressure which has been called *solicitation*, such as the power of gravity. They affirm that there is no such thing as contact on instantaneous communication of motion by real collision. They say, and they prove it by very convincing facts, that the particles of solid bodies exert very strong repulsions to a small distance; and therefore, when they are brought

by motion sufficiently near to another body, they repel it, and are equally repelled by it. Thus is motion produced in the other body, and their own motion is diminished. And they then show, by a scrupulous consideration of the state of the bodies while the one is advancing and the other retiring, in what manner the two bodies attain a common velocity, so that the quantity of motion before collision remains unchanged, the one body gaining as much as the other loses. They also show cases of such mutual action between bodies, where it is evident that they have never come into contact; and yet the result has been precisely similar to those cases where the motion appeared to be changed in an instant. Therefore they conclude that there is no such thing as instantaneous communication, or transfusion of motion, by contact in collision or impulse. The reason why previous motion of the impelling body is necessary, is not that it may have a *vis insita corpori moto*, a force inherent in it *by its being in motion*, but that it may continue to follow the impelled and retiring body, and exert on it a force inherent in itself, whether in motion or at rest. According to these philosophers, therefore, all moving forces are of that kind which has been named *solicitation*, such as gravity. We shall know it afterwards by the more familiar and descriptive name of *accelerating* or *retarding* force.

14. The exertions of mechanical forces are differently termed, according to the reference that we make to the result. If in boxing or wrestling I strike, or endeavour to throw my antagonist, I am said to *act*; but if I only parry his blows, or prevent him from throwing me, I am said to *resist*. This distinction is applied to the exertions of mechanical powers. When one body, A, changes the motion of another, B, we may consider the change in the motion of B either as the indication and measure of A's power of producing motion, or as the indication and measure of A's resistance to the being brought to rest, or having its motion any how changed. The distinction is not in the thing itself, but only in the reference that we are disposed, by other considerations, to make of its effect. They may be distinguished in the following manner: If a change of motion follow when one of the powers ceases to be exerted, that power is conceived as having resisted. The whole language on this subject is metaphorical. Resistance, effort, endeavour, &c. are words which cannot be employed in mechanical discussions without figure, because they all express notions which relate to sentient beings; and the unguarded indulgence of this figurative language has so much affected the imagination of philosophers, that many have almost animated all matter. Perhaps the word *re-action*, introduced by Newton, is the best term for expressing that mutual force which is perceived in all the operations of nature that we have investigated with success. As the magnet attracts iron, and in so doing is said to *act* on it; so the iron attracts the magnet, and may be said to *re-act* on it.

15. With respect to the difficulty that has been objected to the opinion of those who maintain that all the mechanical phenomena are produced by the agency of attracting or repelling forces; namely, that this supposes the bodies to act on each other at a distance, however small those distances may be, which is thought to be absurd, we may observe, that we may ascribe the mutual approaches or recesses to tendencies to or from each other. What we call *the attraction of the magnet* may be considered as a tendency of the iron to the magnet, somewhat similar to the gravitation of a stone toward the earth. We surely (at least the unlearned) can and do conceive the iron to be affected by the magnet, *without thinking* of any intermedium. The thing is not therefore inconceivable, which is all that we know about absurdity; and we do not

We need not suppose action at a distance. Tendency.

Dynamics. know any thing about the nature or essence of matter which renders this tendency to the magnet impossible. That we do not see intuitively any reason why the iron should approach the magnet, must be granted; but this is not enough to entitle us to say that such a thing is impossible, or inconsistent with the nature of matter. It appears, therefore, to be very hasty and unwarrantable to suppose the impulse of an invisible fluid, of which we know nothing, and of the existence of which we have no proof. Nay, if it be true that bodies do not come into contact, even when one ball hits another, and drives it before it, this invisible fluid will not solve the difficulty, because the same difficulty occurs in the action of any particle of the fluid on the body. We are obliged to say that the production of motion without any *observed* contact, is a much more familiar phenomenon than the production of motion by impulsion. More motion has been produced in this way by the gravitation of a small stream of water, running ever since the creation, than by all the impulses in the world twice told. We do not mean by this to say, that the giving to this observed mutual relation between iron and a loadstone the name *tendency* makes it less absurd than when we say that the loadstone attracts the iron; it only makes it more conceivable. It suggests a very familiar analogy; but both are equally figurative expressions, at least as the word *tendency* is used at present. In the language of ancient Rome, there was no metaphor when Virgil's hero said, *Tendimus in Latium*. *Tendere versus solem* means, in plain Latin, to *approach the sun*. The safe way of conceiving the whole is to say that the condition of the iron depends on the vicinity of the magnet.

Attraction, repulsion, are figurative terms. 16. When the exertions of a mechanical power are observed to be always directed toward a body, that body is said to attract; but when the other body always moves off from it, it is said to repel. These also are metaphorical expressions. I attract a boat when I pull it toward me by a rope; this is purely *Attraction*: and it is pure, unfigurative *Repulsion*, when I push any body from me. The same words are applied to the mechanical phenomena, merely because they resemble the results of real attraction or repulsion. We must be much on our guard to avoid metaphor in our conceptions, and never allow those words to suggest to our mind any opinion about the *manner* in which the mechanical forces produce their effects. It is plain, that if the opinion of those who maintain the existence and action of the above-mentioned invisible fluid be just, there is nothing like attraction or repulsion in the universe. We must always recur to the simple phenomenon, the motion to or from the attracting or repelling body; for this is all we see, and generally all that we know.

Forces are conceived as measurable quantities. 17. We conceive one man to have twice the strength of another man, when we see that he can withstand the united effort of two others. Thus animal force is conceived as a quantity, made up of and measured by its own parts. But we doubt exceedingly whether this be an accurate conception. We have not a distinct notion of one strain added to another, though we have of their being joined or combined. We want words to express the difference of these two notions in our own minds, but we imagine that others perceive the same difference. We conceive clearly the addition of two lines or of two minutes; we can conceive them apart, and perceive their boundaries, common to both, where one ends and the other begins. We cannot conceive thus of two forces combined; yet we cannot say that two equal forces are *not* double of one of them. We measure them by the effects which they are known to produce. Yet there are not wanting many cases where the action of two men, equally strong, does not produce a double motion.

In like manner, we conceive all mechanical forces as Dynamics. measurable by their effects; and thus they are made the subjects of mathematical discussion. We talk of the proportions of gravity, magnetism, electricity, &c.; nay, we talk of the proportion of gravity to magnetism: yet these, considered in themselves, are disparate, and do not admit of any proportion; but they produce effects, some of which are measurable, and whose assumed measures are susceptible of comparison, being quantities of the same kind. Thus, one of the effects of gravity is the acceleration of motion in a falling body: magnetism will also accelerate the motion of a piece of iron; these two accelerations are comparable. But we cannot compare magnetism with heat, because we do not know any measurable effects of magnetism that are of the same kind with any effects of heat.

When we say that the gravitation of the moon is the 3600th part of the gravitation at the sea-shore, we mean that the fall of a stone in a second is 3600 times greater than the fall of the moon in the same time. But we also mean (and this expresses the proportion of the *tendency* of gravitation more purely), that if a stone, when hung on a spring steelyard, draw out the rod of the steelyard to the mark 3600, the same stone, taken up to the distance of the moon, will draw it out no farther than the mark 1. We also mean, that if the stone at the sea-shore draw out the rod to any mark, it will require 3600 such stones to draw it out to that mark when the trial is made at the distance of the moon. It is not, therefore, in consequence of any immediate perception of the proportion of the gravitation at the moon to that at the surface of the earth that we make such an assertion; but these motions, which we consider as its effects in these situations, being magnitudes of the same kind, are susceptible of comparison, and have a proportion which can be ascertained by observation. It is these proportions that we contemplate; although we speak of the proportions of the unseen causes, the forces, or endeavours to descend. It will be of material service to the reader to peruse the judicious and acute dissertation on *quantity* in the works of Dr Reid (vol. ii.), where he will see clearly how force, velocity, density, and many other magnitudes of very frequent occurrence in mechanical philosophy, may be made the subjects of mathematical discussion, by means of some of those proper quantities, measurable by their own parts, which are to be assumed as their measures. Pressures are measurable only by pressures. When we consider them as moving powers, we should be able to measure them by *any* moving powers, otherwise we cannot compare them; therefore it is not as pressures that we then measure them. This observation is momentous.

One circumstance must be carefully attended to. That those assumed measures may be accurate, they must be invariably connected with the magnitudes which they are employed to measure, and so connected that the degrees of the one must change in the same manner with the degrees of the other. This is evident, and is granted by all. But we must also *know* this of the measure we employ; we must see this constant and precise relation. How can we know this? We do not perceive force as a separate existence, so as to see its proportions, and to see that these are the same with the proportions of the measures, in the same manner that Euclid sees the proportions of triangles and those of their bases, and that these proportions are the same when the triangles are of equal altitudes. How do we discover that to every magnitude which we call *force* is invariably attached a corresponding magnitude of acceleration or deflection? Clearly. In fact, the very existence of the force is an inference that we make from the observed acceleration; and the degree of

Dynamics. the force is, in like manner, an inference from the observed magnitude of the acceleration. Our measures are therefore necessarily connected with the magnitudes which they measure, and their proportions are the same; because the one is always an inference from the other, both in species and in degree.

Dynamics is a demonstrative science. 18. It is now evident that these disquisitions are susceptible of mathematical accuracy. Having selected our measures, and observed certain mathematical relations of those measures, every inference that we can draw from the mathematical relations of the proportions of those representations is true of the proportions of the motions, and therefore of the proportions of the forces. And thus dynamics becomes a demonstrative science, one of the *disciplinæ accurate*.

19. But moving forces are considered as differing and in kind; that is, in direction. We assign to the force the direction of the observed change of motion, which is not only the indication, but also the characteristic, of the changing force. We call it an *accelerating, retarding, deflecting force*, according as we observe the motion to be accelerated, retarded, or deflected.

These denominations show us incontestably that we have no knowledge of the forces different from our knowledge of the effects. The denominations are all either descriptive of the effects, as when we call them accelerating, penetrating, protrusive, attractive, or repulsive forces; or they are names of reference to the substances in which the accelerating, protrusive, &c. forces are supposed to be inherent, as when we call them *magnetism, electricity, corpuscular, &c.*

Forces are discovered by their opposition to other forces. 20. When I struggle with another, and feel, that in order to prevent being thrown, I must exert force, I learn that my antagonist is exerting force. This motion is transferred to matter; and when a moving power which is *known* to operate produces no motion, we conceive it to be opposed by another equal force, the existence, agency, and intensity of which is detected and measured by these means. The quiescent state of the body is considered as a change on the state of things that would have been exhibited in consequence of the known action of one power, had this other power not acted; and this change is considered as the indication, characteristic, and measure, of another power, detected in this way. Thus forces are recognised not only by the changes of motion which they produce, but also by the changes of motion which they prevent. The cohesion of matter in a string is inferred not only by its giving motion to a ball which I pull toward me by its intervention, but also by its suspending that ball, and hindering it from falling. I know that gravity is acting on the ball, which, however, does not fall. The solidity of a board is equally inferred from its stopping the ball which strikes it, and from the motion of the ball which it drives before it. In this way we learn that the particles of tangible matter cohere by means of moving forces, and that they resist compression with force; and in making this inference, we find that this corpuscular force exerted between the particles is mutual, opposite, and equal; for we must apply force equally to *a* or to *b*, in order to produce a separation or a compression. We learn their equality, by observing that no motion ensues while these mutual forces are known to act on the particles; that is, each is opposed by another force, which is neither inferior nor superior to it.

OF THE LAWS OF MOTION.

Such, then, being our notions of mechanical forces, the causes of the sensible changes of motion, there will result certain consequences from them, which may be called

axioms or laws of motion. Some of these may be intuitive, offering themselves to the mind as soon as the notions which they involve are presented to it. Others may be as necessary results from the relations of these notions, but may not readily offer themselves without the mediation of axioms of the first class. We shall select those which are intuitive, and may be taken for the first principles of all discussions in mechanical philosophy.

FIRST LAW OF MOTION.

Every body continues in a state of rest, or of uniform rectilinear motion, unless affected by some mechanical force.

21. This is a proposition, on the truth of which the whole science of mechanical philosophy ultimately depends. It is therefore to be established on the firmest foundation; and a solicitude on this head is the more justifiable, because the opinions of philosophers have been extremely different, both with respect to the truth of this law, and with respect to the foundation on which it is built. These opinions are, in general, very obscure and unsatisfactory; and, as is natural, they influence the discussions of those by whom they are held through the whole science. Although of contradictory opinions one only can be just, and it may appear sufficient that this one be established and uniformly applied; yet a short exposition, at least, of the rest is necessary, that the greatest part of the writings of the philosophers may be intelligible, and that we may avail ourselves of much valuable information contained in them, by being able to perceive the truth in the midst of their imperfect or erroneous conceptions of it.

22. It is not only the popular opinion that rest is the natural state of body, and that motion is something foreign to it, but it has been seriously maintained by the greatest part of those who are esteemed philosophers. They readily grant that matter will continue at rest unless some moving force act upon it. Nothing seems necessary for matter's remaining where it is, but its continuing to exist. But it is far otherwise, say they, with respect to matter in motion. Here the body is continually changing its relations to other things; therefore the continual agency of a changing cause is necessary (by the fundamental principle of all philosophical discussion), for there is here the continual production of an effect. They say that this metaphysical argument receives complete confirmation (if confirmation of an intuitive truth be necessary) from the most familiar observation. We see that all motions, however violent, terminate in rest, and that the continual exertion of some force is necessary for their continuance.

23. These philosophers therefore assert, that the continual action of the moving cause is *essentially* necessary for the continuance of the motion; but they differ among themselves in their notions and opinions about this cause. Some maintain that all the motions in the universe are produced and continued by the immediate agency of Deity; others affirm, that in every particle of matter there is inherent a sort of mind, the *φύσις* and *ὁσπερ-ψυχή* of Aristotle, which they call an *Elemental Mind*, which is the cause of *all* its motions and changes. An overweening reverence for Greek learning has had a great influence in reviving this doctrine of Aristotle. The Greek and Roman languages are affirmed to be more accurate expressions of human thought than the modern languages are. In those ancient languages, the verbs which express motion are employed both in the active and passive voice; whereas we have only the active verb *to move*, for expressing both the state of motion and the act of putting in motion. "The stone *moves* down the slope, and *moves* all the pebbles which lie in its way;" but in the ancient lan-

Does continued motion indicate continued action?

Whimsical notion of elemental minds.

First Law of Motion. languages, the mere state of motion is always expressed by the passive or middle voice. The accurate conception of the speakers is therefore extolled. The state of motion is expressed as it ought to be, as the result of a continual action. *Kinetai, movetur*, is equivalent to "it is moved." According to these philosophers, every thing which *moves* is mind, and every thing that *is moved* is body.

The argument is futile, and it is false; for the modern languages are, in general, equally accurate in this instance: "*se mouvoir*," in French; "*sich bewegen*," in German; "*dvigatsu*," in Slavonic; are all passive or reflected. And the ancients said that "rain falls, water runs, smoke rises," just as we do. The ingenious author of *Ancient Metaphysics* has taken much pains to give us, at length, the procedures of those elementary minds in producing the ostensible phenomena of local motion; but it seems to be merely an abuse of language, and a very frivolous abuse. This elemental mind is known and characterised only by the effect which we ascribe to its action; that is, by the motions or changes of motions. Uniform and unexcepted experience shows us that these are regulated by laws as precise as those of mathematical truth. We consider nothing as more fixed and determined than the common laws of mechanism. There is nothing here that indicates any thing like spontaneity, intention, purpose; none of those marks by which mind was first brought into view; but they are very like the effects which we produce by the exertions of our corporeal forces; and we have accordingly given the name *force* to the causes of motion. It is surely much more apposite than the name mind, and conveys with much more readiness and perspicuity the very notions that we wish to convey.

Action not necessary for the continuance of motion.

24. We now wish to know what reason we have to think that the continual action of some cause is necessary for continuing matter in motion, or for thinking that rest is its natural state. If we pretend to draw any argument from the nature of matter, that matter must be known, as far as is necessary for being the foundation of argument. Its very existence is known only from observation; all our knowledge of it must therefore be derived from the same source.

If we take this way to come at the origin of this opinion, we shall find that experience gives us no authority for saying that rest is the natural condition of matter. We cannot say that we have ever seen a body at rest; this is evident to every person who allows the validity of the Newtonian philosophy, and the truth of the Copernican system of the sun and planets; all the parts of this system are in motion. Nay, it appears from many observations, that the sun, with his attending planets, is carried in a certain direction, with a velocity which is very great. We have no unquestionable authority for saying that any one of the stars is absolutely fixed; but we are *certain* that many of them are in motion. Rest is therefore so rare a condition of body, that we cannot say, from any experience, that it is its natural state.

25. It is easy, however, to see that it is from observation that this opinion has been derived; but the observation has been limited and careless. Our experiments in this sublunary world do indeed always require continued action of some moving force to continue the motion; and if this be not employed, we see the motions slacken every minute, and terminate in rest after no long period. Our first notions of sublunary bodies are indicated by their operation in cases where we have some interest. Perpetually seeing our own exertions necessary, we are led to consider matter as something not only naturally quiescent and inert, but sluggish, averse from motion, and prone to rest (we must be pardoned this metaphorical language, because we can find no other term). What is expressed

by it, on this occasion, is precisely one of the erroneous or inadequate conceptions that are suggested to our thoughts by reason of the poverty of language. We animate matter in order to give it motion, and then we endow it with a sort of moral character in order to explain the appearance of those motions.

26. But more extended observation has made men gradually desert their first opinions, and at last allow that matter has no peculiar aptitude to rest. All the retardations that we observe have been discovered, one after another, to have a distinct reference to some external circumstances. The diminution of motion is always observed to be accompanied by the removal of obstacles, as when a ball moves through sand, or water, or air; or it is owing to opposite motions which are destroyed; to roughness of the path, or to friction, &c. We find that the more we can keep these things out of the way, the less are the motions diminished. A pendulum will vibrate but a short while in water; much longer in air; and in the exhausted receiver it will vibrate a whole day. We know that we cannot remove *all* obstacles; but we are led by such observations to conclude that, if they *could be completely removed*, our motions would continue for ever. And this conclusion is almost demonstrated by the motions of the heavenly bodies, to which we know of no obstacles, and which we really observe to retain their motions for many thousand years, without the smallest sensible diminution.

27. Another set of philosophers maintain an opinion directly opposite to that of the inactivity of matter, and assert, that it is essentially active, and continually changing its state. Faint traces of this are to be found in the writings of Plato, Aristotle, and their commentators. Mr Leibnitz is the person who has treated this question most systematically and fully. He supposes every particle of matter to have a principle of individuality, which he therefore calls a *Monad*. This monad has a sort of perception of its situation in the universe, and of its relation to every other part of this universe. Lastly, he says that the monad acts on the material particle much in the same way that the soul of man acts on his body. It modifies the motion of the material atom (in conformity, however, to unalterable laws), producing all those modifications of motion that we observe. Matter, therefore, or at least particles of matter, are continually active, and continually changing their situation.

It is quite unnecessary to enter on a formal confutation of Mr Leibnitz's system of monads, which differs very little from the system of elemental minds, and is equally whimsical and frivolous; because it only makes the unlearned reader stare, without giving him any information. Should it even be granted, it would not, any more than the action of animals, invalidate the general proposition which we are endeavouring to establish as the fundamental law of motion. Those powers of the monads, or of the elemental minds, are the causes of all the changes of motion; but the mere material particle is subject to the law, and requires the exertion of the monad in order to exhibit a change of motion.

28. A third sect of philosophers, at the head of which we may place Sir Isaac Newton, maintain the doctrine enounced in the proposition. But they differ much in respect of the foundation on which it is built.

Some assert that this truth flows from the nature of the thing. If a body be at rest, and you assert that it will not remain at rest, it must move in some one direction. If it be in motion in any direction, and with any velocity, and do not continue its equable, rectilineal motion, it must either be accelerated or retarded; it must turn either to one side or to some other side. The event, whatever it be, is individual and determinate; but no cause which

First Law of Motion

Inactivity of matter denied by Leibnitz.

This opinion ill founded.

Some philosophers deduce this law of motion from the want of a determining cause.

from an error of relation is the natural state & that is maintained by relation as well as by absolute rest.

The doctrine of a sufficient reason
First Law can determine it is supposed; therefore the determination cannot take place, and no change will happen in the condition of the body with respect to motion. It will continue at rest, or persevere in its rectilinear and equable motion.

But considerable objections may be made to this argument of *sufficient reason*, as it is called. In the immensity and perfect uniformity of space and time, there is no determining cause why the visible universe should exist in the place in which we see it rather than in another, or at this time rather than at another. Nay, the argument seems to beg the question. A cause of determination is required as essentially necessary—a determination may be without a cause, as well as a motion without a cause.

Others deduce it from experience. 29. Other philosophers, who maintain this doctrine, consider it merely as an experimental truth; and proofs of its universality are innumerable.

When a stone is thrown from the hand, we press it forward while in the hand, and let it go when the hand has acquired the greatest rapidity of motion that we can give it. The stone continues in that state of motion which it acquired gradually along with the hand. We can throw a stone much farther by means of a sling, because, by a very moderate motion of the hand, we can whirl the stone round till it acquire a very great velocity, and then we let go one of the strings, and the stone escapes, *by continuing* its rapid motion. We see it still more distinctly in shooting an arrow from a bow. The string presses hard on the notch of the arrow, and it yields to this pressure and goes forward. The string alone would go faster forward. It therefore *continues* to press the arrow forward, and accelerates its motion. This goes on till the bow is as much unbent as the string will allow. But the string is now a straight line. It came into this position with an accelerated motion, and it therefore goes a little beyond this position, but with a retarded motion, being checked by the bow. But there is nothing to check the arrow, therefore the arrow quits the string and flies away.

These are simple cases of perseverance in a state of motion, where the procedure of nature is so easily traced that we perceive it almost intuitively. It is no less clear in other phenomena which are more complicated; but it requires a little reflection to trace the process. We have often seen an equestrian showman ride a horse at a gallop, standing on the saddle, and stepping from it to the back of another horse that gallops alongside at the same rate; and he does this seemingly with as much ease as if the horses were standing still. The man has the same velocity with the horse that gallops under him, and keeps this velocity while he steps to the back of the other. If that other were standing still, the man would fly over his head. And if a man should step from the back of a horse that is standing still, to the back of another that gallops past him, he would be left behind. In the same manner, a slack-wire dancer tosses oranges from hand to hand while the wire is in full swing. The orange, swinging along with the hand, retains the velocity; and when in the air, follows the hand, and falls into it when it is in the opposite extremity of its swing. A ball dropped from the mast-head of a ship that is sailing briskly forward, falls at the foot of the mast. It retains the motion which it had while in the hand of the person who dropped it, and follows the mast during the whole of its fall.

We also have familiar instances of the perseverance of a body in a state of rest. When a vessel filled with water is drawn suddenly along the floor, the water dashes over the posterior side of the vessel. It is left behind. In the same manner, when a coach or boat is dragged forward, the persons in it find themselves strike against the hinder part of the carriage or boat. Properly speaking, it is the

carriage that strikes on them. In like manner, if we lay a card on the tip of the finger, and a piece of money on the card, we may nick away the card, by hitting it neatly on its edge; but the piece of money will be left behind, lying on the tip of the finger. A ball will go through a wall and fly onward; but the wall is left behind. Buildings are thrown down by earthquakes; sometimes by being tossed from their foundations, but more generally by the ground on which they stand being hastily drawn sidewise from under them, &c.

30. But common experience seems insufficient for establishing this fundamental proposition of mechanical philosophy. We must, on the faith of the Copernican system, grant that we never saw a body at rest, or in uniform rectilinear motion; yet this seems absolutely necessary before we can say that we have established this proposition experimentally.

What we imagine, in our experiments, to be putting a body, formerly at rest, into motion, is, in fact, only changing a most rapid motion, not less, and probably much greater, than 90,000 feet per second. Suppose a cannon pointed east, and the bullet discharged at noon day with sixty times greater velocity than we have ever been able to give it: it would appear to set out with this unmeasurable velocity to the eastward, to be gradually retarded by the resistance of the air, and at last brought to rest by hitting the ground. But, by reason of the earth's motion round the sun, the fact is quite the reverse. Immediately before the discharge, the ball was moving to the westward with the velocity of 90,000 feet per second nearly. By the explosion of the powder, and its pressure on the ball, some of this motion is destroyed, and at the muzzle of the gun the ball is moving slower, and the cannon is hurried away from it to the westward. The air, which is also moving to the westward 90,000 feet in a second, gradually communicates motion to the ball, in the same manner as a hurricane would do. At last (the ball dropping all the while) some part of the ground hits the ball, and carries it along with it.

Other observations must therefore be resorted to, in order to obtain an experimental proof of this proposition; and such are to be found. Although we cannot measure the absolute motions of bodies, we can observe and measure accurately their relative motions, which are the differences of their absolute motions. Now, if we can show experimentally that bodies show equal tendencies to resist the augmentation and the diminution of their relative motions, they, *ipso facto*, show equal tendencies to resist the augmentation or diminution of their absolute motions. Therefore let two bodies, A and B, be put into such a situation that they cannot (by reason of their impenetrability, or the action of their mutual powers) persevere in their relative motions. The change produced on A is the effect and the measure of B's tendency to persevere in its former state; and therefore the proportion of these changes will show the proportion of their tendencies to maintain their former states. Therefore let the following experiment be made at noon.

Let A, apparently moving westward three feet per second, hit the equal body B apparently at rest. Suppose, 1st, that A impels B forward without any diminution of its own velocity. This result would show that B manifests no tendency to maintain its motion unchanged, but that A retains its motion undiminished.

2dly, Suppose that A stops, and that B remains at rest. This would show that A does not resist a diminution of motion, but that B retains its motion unaugmented.

3dly, Suppose that both move westward with the velocity of one foot per second. The change on A is a diminution of velocity, amounting to two feet per second.

First Law of Motion. This is the effect and the measure of B's tendency to maintain its velocity unaugmented. The change on B is an augmentation of one foot per second made on its velocity; and this is the measure of A's tendency to maintain its velocity undiminished. This tendency is but half of the former; and this result would show that the resistance to a diminution of velocity is but half of the resistance to augmentation. It is perhaps but one quarter, for the change on B has produced a double change on A.

4thly, Suppose that both move westward at the rate of one and a half foot per second. It is evident that their tendencies to maintain their states unchanged are now equal.

5thly, Suppose $A = 2B$, and that both move, after the collision, two feet per second; B has received an addition of two feet per second to its former velocity. This is the effect and the measure of A's whole tendency to retain its motion undiminished. Half of this change on B measures the persevering tendency of the half of A; but A, which formerly moved with the apparent or relative velocity three, now moves (by the supposition) with the velocity two, having lost a velocity of one foot per second. Each half of A therefore has lost this velocity, and the whole loss of motion is two. Now this is the measure of B's tendency to maintain its former state unaugmented; and this is the same with the measure of A's tendency to maintain its own former state undiminished. The conclusion from such a result would therefore be, that bodies have equal tendencies to maintain their former states of motion without augmentation and without diminution.

What is supposed in the fourth and fifth cases is really the result of all the experiments which have been tried; and this law regulates all the changes of motion which are produced by the mutual actions of bodies in impulsions. This assertion is true without exception or qualification. Therefore it appears that bodies have no preferable tendency to rest, and that no fact can be adduced which should make us suppose that a motion once begun should suffer any diminution without the action of a changing cause.

But experience is not the proper foundation of an axiom.

But we must now observe, that this way of establishing the first law of motion is very imperfect, and altogether unfit for rendering it the fundamental principle of a whole and extensive science. It is subject to all the inaccuracy that is to be found in our best experiments; and it cannot be applied to cases where scrupulous accuracy is wanted, and where no experiment can be made.

Let us therefore examine the proposition by means of principles which contain the foundation of all our knowledge of active nature. These will, we imagine, give a decision of this question that is speedy and accurate; showing the proposition to be an axiom or intuitive consequence of the relations of those ideas which we have of motion, and of the causes of its production and changes.

Logical proof.

31. It has been fully demonstrated that the powers or forces of which we speak so much are never the immediate objects of our perception. Their very existence, their kind, and their degree, are instinctive inferences from the motions which we observe and class. It evidently follows from this experimental and universal truth, *1st*, that where no change of motion is observed, no such inference is made, that is, no power is *supposed* to act. But whenever any change of motion is observed, the inference is made; that is, a power or force is supposed to have acted.

In the same form of logical conclusion, we must say that, *2dly*, when no change of motion is *supposed* or thought of, no force is *supposed*; and that whenever we *suppose* a change of motion, we in fact, though not in terms, suppose a changing force. And, on the other hand, whenever we suppose the action of a changing force, we

suppose the change of motion; for the action of this force, and the change of motion, is one and the same thing. We cannot think of the action without thinking of the indication of that action; that is, the change of motion. In the same manner, when we do not think of a changing force, or suppose that there is no action of a changing force, we in fact, though not in terms, suppose that there is no indication of this changing force; that is, that there is no change.

Whenever, therefore, we suppose that no mechanical force is acting on a body, we in fact suppose that the body continues in its former condition with respect to motion. If we suppose that nothing accelerates, or retards, or deflects the motion, we suppose that it is not accelerated, nor retarded, nor deflected. Hence follows the proposition in express terms—*We suppose that the body continues in its former state of rest or motion, unless we suppose that it is changed by some mechanical force.*

Thus it appears that this proposition is not a matter of experience or contingency, depending on the properties which it has pleased the Author of nature to bestow on body; it is to us a necessary truth. The proposition does not so much express any thing with regard to body, as it does the operations of our mind when contemplating body. It may perhaps be essential to body to move in some particular direction. It may be essential to body to stop as soon as the moving cause has ceased to act; or it may be essential to body to diminish its motion gradually, and finally come to rest. But this will not invalidate the truth of this proposition. These circumstances in the nature of body, which render those modifications of motion essentially necessary, are the causes of those modifications; and in our study of nature they will be considered by us as changing forces, and will be known and called by that name. And if we should ever see a particle of matter in such a situation that it is affected by those essential properties alone, we shall, from observation of its motion, discover what those essential properties are.

This law turns out at last to be little more than a tautological proposition; but mechanical philosophy, as we have defined it, requires no other sense of it; for even if we should suppose that body, of its own nature, is capable of changing its state, this change must be performed according to some law which characterizes the nature of body; and the knowledge of the law can be had in no other way than by observing the deviations from uniform rectilinear motion. It is therefore indifferent whether those changes are derived from the nature of the thing or from external causes; for, in order to consider the various motions of bodies, we must first consider this nature of matter as a mechanical affection of matter, operating in every instance; and thus we are brought back to the law enounced in this proposition. This becomes more certain when we reflect that the external causes (such as gravity or magnetism), which are acknowledged to operate changes of motion, are equally unknown to us with this essential original property of matter, and are, like it, nothing but inferences from the phenomena.

The above very diffuse discussions may appear superfluous to many readers, and even cumbersome; but we trust that the philosophical reader will excuse our anxiety on this head, when he reflects on the complicated, indistinct, and inaccurate notions commonly had of the subject. We may include Sir Isaac Newton in the number of those who have at least introduced modes of expression which mislead the minds of incautious persons, and suggest inadequate notions, incompatible with the pure doctrine of the proposition. Although in words they disclaim the doctrine that rest is the natural state of body, and that force is necessary for the continuation of its motion,

It is a law of human thought,

Good

and almost identical proposition.

First Law
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of Motion.

yet in words they (and most of them in thought) likewise abet that doctrine: for they say that there resides in a moving body a *power* or *force*, by which it perseveres in its motion. They call it the *vis insita*, the *inherent force*, of a moving body. This is surely giving up the question: for if the motion is supposed to be continued in consequence of a force, that force is *supposed* to be exerted; and it is supposed that if it were not exerted, the motion would cease; and therefore the proposition must be false. Indeed it is sometimes expressed so as seemingly to ward off this objection. It is said that the body continues in uniform rectilinear motion, unless affected by some *external cause*. But this way of speaking obliges us, at first setting out in natural philosophy, to assert that gravity, magnetism, electricity, and a thousand other mechanical powers, are external to the matter which they put in motion. This is quite improper. It is the business of philosophy to discover whether they be external or not; and if we assert that they are, we have no principles of argumentation with those who deny it. It is this one thing that has filled the study of nature with all the jargon of ethers, and other invisible, intangible fluids, which has disgraced philosophy, and greatly retarded its progress.

Vis insita, inherent force, are improper terms in their usual acceptance.

32. We must observe, that the terms *vis insita*, inherent force, are very improper. There is no dispute among philosophers in calling every thing a force that produces a change of motion, and in inferring the action of such a force whenever we observe a change of motion. It is surely incongruous to give the same name to what has not this quality of producing a change, or to infer (or rather to suppose) the energy of a force when no change of motion is observed. This is one among many instances of the danger of mistake when we indulge in analogical discussions. All our language, at least, on this subject is analogous. I feel that in order to oppose animal force I must exert force. But I must exert force in order to oppose a body in motion; therefore I imagine that the moving body possesses force. A bent spring will drive a body forward by unbending; therefore I say that the spring exerts force. A moving body impels the body which it hits; therefore I say that the impelling body possesses and exerts force. I imagine farther, that it possesses force only by being in motion, or because it is in motion; because I do not find that a quiescent body will put another into motion by touching it. But we shall soon find this to be false in many, if not in all cases, and that the communication of motion depends on the mere vicinity, and not on the motion of the impelling body; yet we ascribe the exertion of the *vis insita* to the circumstance of the continued motion. We therefore conceive the force as arising from or as consisting in the impelling body's being in motion; and, with a very obscure and indistinct conception of the whole matter, we call it *the force by which the body preserves itself in motion*. Thus, taking it for granted that a force resides in the body, and being obliged to give it some office, this is the only one that we can think of.

33. But philosophers imagine that they perceive the necessity of the exertion of a force in order to the continuation of a motion. Motion (say they) is a continued action; the body is every instant in a new situation; there is the continual production of an effect, therefore the continual action of a cause.

Motion is not the continual production of an effect.

This, however, is a very inaccurate way of thinking. We have a distinct conception of motion; and we conceive that there is such a thing as a moving cause, which we distinguish from all other causes by the name *force*. It produces motion. If it does this, it produces the character of motion, which is a continual change of place. Motion is not action, but the effect of an action; and this

action is as complete in the instant immediately succeeding the beginning of the motion as it is a minute after. The subsequent change of place is the continuation of an effect already produced. The *immediate* effect of the moving force is a *determination*, by which, if not hindered, the body would go on for ever from place to place. It is in this determination only that the state or condition of the body can differ from a state of rest; for in any instant the body does not describe any space, but has a determination by which it will describe a certain space uniformly in a certain time. Motion is a condition, a state, or mode of existence, and no more requires the continued agency of the moving cause than yellowness or roundness does. It requires some chemical agency to change the yellowness to greenness; and it requires a mechanical cause or a force to change this motion into rest. When we see a moving body stop short in an instant, or be gradually but quickly brought to rest, we never fail to speculate about a cause of this cessation or retardation. The case is no way different in itself although the retardation should be extremely slow. We should always attribute it to a cause. It requires a cause to put a body out of motion, as much as to put it into motion. This cause, if not external, must be found in the body itself; and it must have a self-determining power, and may as well be able to put itself into motion as out of it.

If this reasoning be not admitted, we do not see how any effect can be produced by any cause. Every effect supposes something *done*; and any thing done implies that the thing done may remain till it be *undone* by some other cause. Without this it would have no existence. If a moving cause did not produce continued motion by its instantaneous action, it could not produce it by any continuance of that action; because in no instant of that action does it produce continued motion.

We must therefore give up the opinion, that there resides in a moving body a force *by which it is kept in motion*; and we must find some other way of explaining that remarkable difference between a moving body and a body at rest, by which the first causes other bodies to move by hitting them, while the other does not do this by merely touching them. We shall see, with the clearest evidence, that motion is necessary in the impelling body, in order that it may permit the forces inherent in one or both bodies to continue this pressure long enough for producing a sensible or considerable motion. But these moving forces are inherent in bodies, whether they are in motion or at rest.

34. The foregoing observations show us the impropriety of the phrase *communication of motion*. By thus reflecting on the notions that are involved in the general conception of one body being made to move by the impulse of another, we perceive that there is nothing individual transferred from the one body to the other. The determination to motion, indeed, existed only in the impelling body before collision; whereas, afterwards, both bodies are so conditioned or determined. But we can form no notion of the thing transferred. With the same metaphysical impropriety we speak of the communication of joy, of fever.

35. Kepler introduced a term *inertia*, *vis inertiae*, into mechanical philosophy; and it is now in constant use. But writers are very careless and vague in the notions which they affix to these terms. Kepler and Newton seem generally to employ it for expressing the fact, the perseverance of the body in its present state of motion or rest: but they also frequently express by it something like an indifference to motion or rest, *manifested by its requiring the same quantity of force to make an augmentation of its motion as to make an equal diminution of it*. The popular notion is

First Law of Motion. like that which we have of actual resistance; and it always implies the notion of force exerted by the resisting body.

We suppose this to be the exertion of the *vis insita*, or the *inherent force* of a body in motion. But we have the same notion of resistance from a body at rest which we set in motion. Now surely it is in direct contradiction to the common use of the word *force*, when we suppose resistance from a body at rest; yet *vis inertiae* is a very common expression. Nor is it more absurd (and it is very absurd) to say, that a body maintains its state of rest by the exertion of a *vis inertiae*, than to say that it maintains its state of motion by the exertion of an *inherent force*. We should avoid all such metaphorical expressions as *resistance*, *indifference*, *sluggishness*, or *proneness to rest* (which some express by *inertia*) because they seldom fail to make us indulge in metaphorical notions, and thus lead us to misconceive the *modus operandi*, or procedure of nature.

There is no resistance whatever observed in these phenomena, for the force employed always produces its complete effect. When I throw down a man, and find that I have employed no more force than was sufficient to throw down a similar and equal mass of dead matter, I know by this that he *has not* resisted; but I conclude that he *has* resisted if I have been obliged to employ much more force. There is therefore no resistance, properly so called, when the exerted force is observed to produce its full effect. To say that there is resistance, is therefore a real misconception of the way in which mechanical forces have operated in the collision of bodies. There is no more resistance in these cases than in any other natural changes of condition. We are guilty, however, of the same impropriety of language in other cases, where the cause of it is more evident. We say that colours in grain resist the action of soap and of the sun, but that Prussian blue does not. We all perceive that in this expression the word resistance is entirely figurative; and we should say that Prussian blue *resists* soap, if we are right in saying that a body resists any force employed to change its state of motion; for soap must be employed to discharge or change the colour, and it does change it. Force must be employed to change a motion, and it does change it. The impropriety, both of thought and language, is plain in the one case, and it is no less real in the other. Both of the terms *inherent force* and *inertia* may be used with safety for abbreviating language, if we be careful to employ them only for expressing either the simple fact of persevering in the former state, or the necessity of employing a certain determinate force in order to change that state, and if we avoid all thought of resistance.

Deviations from uniform rectilinear motion are the only indications of force. 36. From the whole of this discussion we learn that the deviations from uniform motions are the indications of the existence and agency of mechanical forces, and that they are the only indications. The indication is very simple—mere change of place; it can therefore indicate nothing but what is very simple, the something competent to the production of the very motion that we observe; and when two changes of motion are precisely similar, they indicate the same thing. Suppose a mariner's compass on the table, and that by a small tap with my finger I cause the needle to turn off from its quiescent position ten degrees. I can do the same thing by bringing a magnet near it, or by bringing an electrified body near it, or by the unbending of a fine spring pressing it aside, or by a puff of wind, or by several other methods. In all these cases the indication is the same; therefore the thing indicated is the same, namely, a certain intensity and direction of a moving power. How it operates, or in what manner it exists and exerts itself in these instances, outwardly so different, is not under consideration at present. Impulsiveness, intensity, and direction, are all the circumstances of

resemblance by which the affections of matter are to be characterized; and it is to the discovery and determination of these alone that our attention is now to be directed. We are directed in this research by the

Second Law of Motion.

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Every change of motion is proportional to the force impressed, and is made in the direction of that force.

37. This law also may almost be considered as an identical proposition; for it is equivalent to saying that the changing force is to be measured by the change which it produces, and that the direction of this force is the direction of the change. Of this there can be no doubt, when we consider the force in no other sense than that of the cause of motion, paying no attention to the form or manner of its exertion. Thus, when a pellet of tow is shot from a pop-gun by the expansion of the air compressed by the rammer, or where it is shot from a toy pistol by the unbending of the coiled wire, or when it is nicked away by the thumb like a marble—if, in all these cases, it moves off in the same direction, and with the same velocity, we cannot consider or think of the force, or at least of its exertion, as any how different. Nay, when it is driven forward by the instantaneous percussion of a smart stroke, although the manner of producing this effect (if possible) is essentially different from what is conceived in the other cases, we must still think that the propelling force, considered as a propelling force, is one and the same. In short, this law of motion, as thus expressed by Sir Isaac Newton, is equivalent to saying, "that we take the changes of motion as the measures of the changing forces, and the direction of the change for the indication of the direction of the forces:" for no reflecting person can pretend to say that it is a deduction from the acknowledged principle, that effects are proportional to their causes. We do not affirm this law from having observed the proportion of the forces and the proportion of the changes, and that these proportions are the same; and from having observed that this has obtained through the whole extent of our study of nature. This would indeed establish it as a physical law, an universal fact; and it is, in fact, so established. But this does not establish it as a law of motion, according to our definition of that term; as a law of human thought, the result of the relations of our ideas, as an intuitive truth. The injudicious attempts of philosophers to prove it as a matter of observation, have occasioned the only dispute that has arisen in mechanical philosophy. It is well known that a bullet moving with double velocity penetrates four times as far. Many other similar facts corroborate this; and the philosophers observe, that four times the force has been expended to generate this double velocity in the bullet; it requires four times as much powder. In all the examples of this kind it would seem that the ratio of the forces employed has been very accurately ascertained; yet this is the invariable result. Philosophers, therefore, have concluded that moving forces are not proportional to the velocities which they produce, but to the squares of those velocities. It is a strong confirmation to see that the bodies in motion seem to possess forces in this very proportion, and produce effects in this proportion; penetrating four times as deep when the velocity is only twice as great, &c.

But if this be a just estimation, we cannot reconcile it to the concession of the same philosophers, who grant that the velocity is proportional to the force impressed, in the cases where we have no previous observation of the ratio of the forces, and of its equality to the ratio of the velocities. This is the case with gravity, which these

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philosophers always measure by its accelerating power, or the velocity which it generates in a given time. And this cannot be refused by them; for cases occur where the force can be measured in the most natural manner by the actual pressure which it exerts. Gravity is thus measured by the pressure which a stone exerts on its supports. A weight which at Quito will pull out the rod of a spring steelyard to the mark 312, will pull it to 313 at Spitzbergen; and it is a fact, that a body will fall 313 inches at Spitzbergen in the same time that it falls 312 at Quito. Gravitation is the cause both of the pressure and the fall, and it is a matter of unexcepted observation that they have always the same ratio. The philosophers who have so strenuously maintained the other measure of forces are among the most eminent of those who have examined the motions produced by gravity, magnetism, electricity, &c.; and they never think of measuring those forces any other way than by the velocity. It is in this way that the whole of the celestial phenomena are explained in perfect uniformity with observation, and that the Newtonian philosophy is considered as a demonstrative science.

There must, therefore, be some defect in the principle on which the other measurement of forces is built, or in the method of applying it. Pressure is undoubtedly the immediate and natural measure of force; yet we know that four springs, or a bow four times as strong, give only a double velocity to an arrow.

The truth of our law rests on this only, that we assume the changes of motion as the measure of the changing forces, or at least as the measures of their exertions in producing motion. In fact, they are the measures only of a certain circumstance, in which the actions of very different natural powers may resemble each other, namely, the competency to produce motion. They do not, perhaps, measure their competency to produce heat, or even to bend springs. We can surely consider this apart from all other circumstances, and it is worthy of separate consideration. Let us see what can be, and what ought to be, deduced from this way of treating the subject.

Change of
motion is
itself a
motion.

38. The motion of a body may certainly remain unchanged. If the direction and velocity remain the same, we perceive no circumstance in which its condition with respect to motion differs. Its change of place or situation can make no difference; for this is implied in the very circumstance of the bodies being in motion.

But if either the velocity or direction change, then surely is its mechanical condition no longer the same; a force has acted on it, either intrinsic or from without, either accelerating, or retarding, or deflecting it. Supposing the direction to remain the same, its difference of condition can consist in nothing but its difference of velocity. This is the only circumstance in which its condition can differ, as it passes through two different points of its rectilinear path. It is this determination by which the body will describe a certain determinate space uniformly in a given time, which defines its condition as a moving body; the changes of this determination are the measures of their own causes, and to those causes we have given the name *force*. Those causes may reside in other bodies, which may have other properties, characterized and measured by other effects. Pressure may be one of those properties, and may have its own measures; these may or may not have the same proportion with that property which is the cause of a change of velocity; and therefore changes of velocity may not be a measure of pressure. This is a question of fact, and requires observation and experience; but, in the mean time, velocity, and the change of velocity, is the measure of moving force and of changing force. When, therefore, the change of velocity is the same what-

ever the previous velocity may be, the changing force must be considered as the same. Therefore, finally, if the previous velocity is nothing, and consequently the change on that body is the very velocity or motion that it acquires, we must say, that the force which produces a certain change in the velocity of a moving body is the same with the force which would impart to a body at rest a velocity equal to this change or difference of velocity produced on the body already in motion.

39. This manner of estimating force is in perfect conformity to our most familiar notions on these subjects. We conceive the weight or downward pressure of a body as the cause of its motion downwards; and we conceive it as belonging to the body at all times, and in all places, whether falling, or rising upwards, or describing a parabola, or lying on a table; and, accordingly, we observe, that in every state of motion it receives equal changes of velocity in the same or an equal time, and all in the direction of its pressure.

40. All that we have now said of a change of velocity might be repeated of a change of direction. It is surely possible that the same change of direction may be made on any two motions. Let one of the motions be considered as growing continually slower, and terminating in rest. In every instant of this motion it is possible to make one and the same change on it. The same change may therefore be made at the very instant that the motion is at an end. In this case the change is the very motion which the body acquires from the changing force. Therefore, in this case also, we must say that a change of motion is itself a motion, and that it is the motion which the force would produce in a body that was previously at rest.

41. The result of these observations is evidently this, *How ascertained and measured.* that we must ascertain, in every instance, what is the change of motion, and mark it by characters that are conspicuous and distinguishing; and this mark and measure of change must be a motion. Then we must say, that the changing force is that which would produce this motion in a body previously at rest. We must see how this is manifest as a motion in the difference between the former motion and the new motion; and, on the other hand, we must see how the motion produceable in a quiescent body may be so combined with a motion already existing as to exhibit a new motion, in which the agency of the changing force may appear.

Suppose a ship at anchor in a stream, while one man walks forward on the quarter deck at the rate of two miles per hour, another walks from stem to stern at the same rate, a third walks athwart ship, and a fourth stands still. Let the ship be supposed to cut or part her cable, and float down the stream at the rate of three miles per hour. We cannot conceive any difference in the change made on each man's motion in absolute space; but their motions are now exceedingly different from what they were: the first man, whom we may suppose to have been walking westward, is now moving eastward one mile per hour; the second is moving eastward four miles per hour, and the third is moving in an oblique direction, about three points north or south of due east. All have suffered the same change of condition with the man who had been standing still. He has now got a motion eastward three miles per hour. In this instance, we see very well the circumstance of sameness that obtains in the change of these four conditions. It is the motion of the ship which is blended with the other motions. But this circumstance is equally present whenever the same previous motions are changed into the same new motions. We must learn to expiscate this; which we shall do by considering the manner in which the motion of the ship is blended with each of the men's motions.

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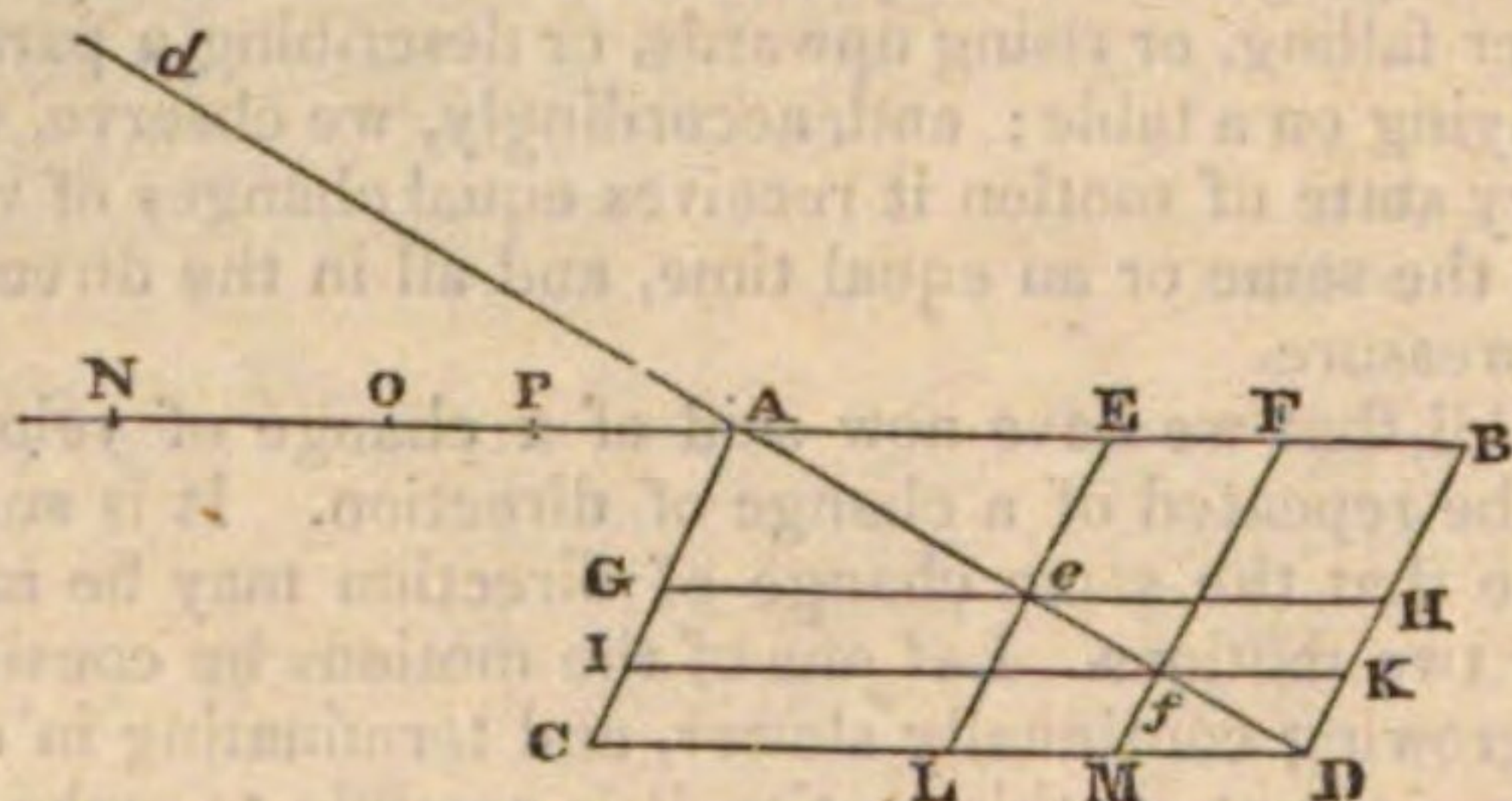
Composi-
tion of mo-
tion.

42. This kind of combination has been called the *composition of motion*; because, in every point of the motion really pursued, the two motions are to be found.

The fundamental theorem on this subject is this: Two uniform motions in the sides of a parallelogram compose an uniform motion in the diagonal.

Suppose that a point A (fig. 1) describes AB uniformly in some given time, while the line AB is carried uniformly along AC in the same time, keeping always parallel to its first position AB. The point A, by the combination of these motions, will describe AD, the diagonal of the parallelogram ABDC, uniformly in the same time.

Fig. 1.



For it is plain that the velocities in AB and AC are proportional to AB and AC, because they are uniformly described in the same time. When the point has got to E, the middle of AB, the line AB has got into the situation GH, half way between AB and CD, and the point E is in the place *e*, the middle of GH. Draw *EeL* parallel to AC. It is plain that the parallelograms ABDC and *AeL* are similar; because *AE* and *AG* are the halves of *AB* and *AC*, and the angle at *A* is common to both. Therefore, by a proposition in the elements, they are about the same diagonal, and the point *e* is in the diagonal of *AD*. In like manner, it may be shown, that when *A* has described *AF*, three fourths of *AB*, the line *AB* will be in the situation *IK*; so that *AI* is three fourths of *AC*, and the point *f*, in which *A* is now found, is in the diagonal *AD*. It will be the same in whatever point of *AB* the describing point *A* be supposed to be found. The line *AB* will be on a similar point of *AC*, and the describing point will be in the diagonal *AD*.

Moreover, the motion in *AD* is uniform; for *Ae* is described in the time of describing *AE*; that is, in half the time of describing *AB*, or in half the time of describing *AD*. In like manner, *Af* is described in three fourths of the time of describing *AD*, &c. &c.

Lastly, the velocity in the diagonal *AD* is to the velocity in either of the sides as *AD* is to that side. This is evident, because they are uniformly described in the same time.

This is justly called a *composition of the motions AB and AC*, as will appear by considering it in the following manner: Let the lines *AB*, *AC* be conceived as two material lines like wires. Let *AB* move uniformly from the situation *AB* into the situation *CD*, while *AC* moves uniformly into the situation *BD*. It is plain that their intersection will always be found on *AD*. The point *e*, for example, is a point common to both lines. Considered as a point of *EL*, it is then moving in the direction *eH* or *AB*; and considered as a point of *GH*, it is moving in the direction *eL*. Both of these motions are therefore blended in the motion of the intersection along *AD*. We can conceive a small ring at *e* embracing loosely both of the wires. This material ring will move in the diagonal, and will really *partake* of both motions.

Thus we see how the motion of the ship is actually blended with the motions of the three men; and the cir-

cumstance of sameness which is to be found in the four changes of motion is this motion of the ship, or of the man who was standing still. By composition with each of the three former motions, it produces each of the three new motions. Now, when each of two primitive motions is the same, and each of the new motions is the same, the change is surely the same. If one of the changes has been brought about by the actual composition of motions, we know precisely what that change is; and this informs us what the other is, in whatever way it was produced.

Hence we infer that,

43. When a motion is any how changed, the change is that motion which, when compounded with the former motion, will produce the new motion. Now, because we assume the change as the measure and characteristic of the changing force, we must do so in the present instance; and we must say,

44. That the changing force is that which will produce in a quiescent body the motion which, by composition with the former motion of a body, will produce the new motion.

And, on the other hand,

When the motion of a body is changed by the action of any force, the new motion is that which is compounded of the former motion, and of the motion which the force would produce in a quiescent body.

When a force changes the direction of a motion, we see that its direction is transverse in some angle *BAC*; because a diagonal *AD* always supposes two sides. As we have distinguished any change of direction by the term *deflection*, we may call the transverse force a *deflecting force*.

In this way of estimating a change of motion, all the characters of both motions are preserved, and it expresses every circumstance of the change; the mere change of direction, or the angle *BAD*, is not enough, because the same force will make different angles of deflection, according to the velocity of the former motion, or according to its direction. But in this estimation the full effect of the deflecting force is seen; it is seen as a motion; for when half of the time is elapsed, the body is at *e* instead of *E*; when three fourths are elapsed it is at *f* instead of *F*; and at the end of the time it is at *D* instead of *B*. In short, the body has moved uniformly away from the points at which it would have arrived independent of the change; and this motion has been in the same direction, and at the same rate, as if it had moved from *A* to *C* by the changing force alone. Each force has produced its full effect; for when the body is at *D*, it is as far from *AC* as if the force *AC* had not acted on it; and it is as far from *AB* as it would have been by the action of *AC* alone.

For all these reasons, therefore, it is evident, that if we are to abide by our measure and character of force as a mere producer of motion, we have selected the proper characteristic and measure of a changing force; and our descriptions, in conformity to this selection, must be agreeable to the phenomena of nature, and retain the accuracy of geometrical procedure; because, on the other hand, the results which we deduce from the supposed influence of those forces are formed in the same mould. It is not even requisite that the real exertions of the natural forces, such as pressure of various kinds, &c. shall follow these rules; for their deviations will be considered as new forces, although they are only indications of the differences of the real forces from our hypothesis. We have obtained the precious advantage of mathematical investigation, by which we can examine the law of exertion which characterizes every force in nature.

45. On these principles we establish the following fundamental elementary proposition, of continual and indispensable use in all mechanical inquiries.

Second
Law of
Motion.

Its mark
and mea-
sure.

Changing
force.

Its effect.

Deflecting
force.

Second
Law of
Motion.

Funda-
mental
theorem.

Second
Law of
Motion.

Objections
to the de-
monstra-
tion of No.
45. It will
not apply
to pres-
sures.

Composi-
tion of
forces.

Resolution
of forces.

Usual de-
monstra-
tion incon-
clusive.

If a body or material particle be subjected at the same time to the action of two moving forces, each of which would separately cause it to describe the side of a parallelogram uniformly in a given time, the body will describe the diagonal uniformly in the same time.

For the body, whose motion AB was changed into AD, had gotten its motion by the action of some force. It was moving along NAB, and when it reached the point A, the force AC acted on it. The primitive motion is the same, or the body is in the same condition in every instant of the primitive motion. It may have acquired this motion when it was in N, or when at O, or any other point of NA. In all these cases, if AC act on it when it is in A, it will always describe AD; therefore it will describe AD when it acquires the primitive motion also in A; that is, if the two forces act on it at one and the same instant. The demonstration may be neatly expressed thus: The change induced by each force on the motion produced by the other is the motion which it would produce in the body if previously at rest. Therefore the motion resulting from joint action is the motion which is compounded of these two motions, or it is a motion in the diagonal of the parallelogram, of which these motions are the sides.

This is called the *composition of forces*. The forces which produce the motions along the sides of the parallelogram are called the *simple forces*, or the *constituent forces*; and the force which would alone produce the motion along the diagonal is called the *compound force*, the *resulting force*, the *equivalent force*.

46. On the other hand, the force which produces a motion along any line whatever may be conceived as resulting from the combined action of two or more forces. We may *know* or *observe* it to be so; as when we see a lighter dragged along a canal by two horses, one on each side. Each pulls the boat directly toward himself in the direction of the track-rope; the boat cannot go both ways, and its real motion, whatever it is, results from this combined action. This might be produced by a single force; for example, if the lighter be dragged along the canal by a rope from another lighter which precedes it, being dragged by one horse, aided by the helm of the foremost lighter. Here the real force is not the resulting, or the compound, but the equivalent force.

This view of a motion mechanically produced is called the *resolution of forces*. The force in the diagonal is said to be *resolved* into the two forces, having the directions and velocities represented by the sides. This practice is of the most extensive and multifarious use in all mechanical disquisitions. It may frequently be exceedingly difficult to manage the complication of the many real forces which concur in producing a phenomenon; and by substituting others, whose combined effects are equivalent, our investigation may be much expedited. But more of this afterwards.

We must carefully remember, that when the motion AD is once begun, all composition is at an end, and the motion is a simple motion. The two determinations, by one of which the body would describe AB, and by the other of which it would describe AC, no longer *co-exist* in the body. This was the case only *in the instant*, in the very act of changing the motion AB into the motion BD; yet is the motion AD equivalent to a motion which is produced by the *actual composition* of two motions AB and AC; in which case the two motions co-exist in every point of AD.

47. Accordingly this is the way in which the composition of forces is usually illustrated, and thought to be demonstrated. A man is supposed (for instance) to walk uniformly from A to C on a sheet of ice, while the ice is carried uniformly along AB by the stream. The man's

real motion is undoubtedly along AD; but this is by no means a demonstration that the instantaneous or short-lived action of two forces would produce that motion; the man must continue to exert force in order to walk; and the ice is dragged along by the stream. Some indeed express this proof in another way, saying, let a body describe AB, while the space in which this motion is performed is carried along AC. The ice may be carried along, and may, by friction or otherwise, drag the man along with it; but a space cannot be removed from one place to another, nor, if it could, would it take the man with it. Should a ship start suddenly forward while a man is walking across the deck, he would be left behind, and fall toward the stern. We must *suppose* a transverse force, and we must *suppose* the composition of this force without proof. This is no demonstration.

We apprehend, that the demonstration given above of this fundamental proposition is unexceptionable, when the terms force and deflection are used in the abstract sense which we have affixed to them. The only circumstance in it which can be the subject of discussion is, whether we have selected the proper measure and characteristic of a change of motion. We never met with any objection to it.

48. But some have still maintained that it does not evidently appear from these principles, that the motion which results from the joint action of two natural powers, whose known and measurable intensities have the same proportions with AB and BC, and which also exert themselves in those directions, will produce a motion having the direction and proportion of AD. They will not, if the velocities produced by these forces are not in the proportion of those intensities, but in the subduplicate ratio of them. Nay, they say that it is not so. If a body be impelled along AC by one spring, and along AB by two springs equally strong, it will not describe the diagonal of a parallelogram, of which the side AB is double the side AC. They add, that an indefinite number of examples can be given where a body *does not* describe the diagonal of the parallelogram by the joint action of two forces, which separately would cause it to describe the sides. And lastly, they say that at any rate it does not appear evident to the mind, that two *incitements* to motion, having the directions and the same proportion of intensity with that of the sides of a parallelogram, actually generate a third, which is the immediate cause of the motion in the diagonal. An equivalent force is not the same with a resulting force.

49. Yet we see numberless cases of the composition of incitements to motion, and they seem as determinate and as susceptible of being combined by composition, as the things called moving forces, which are measured by the velocities. We see them actually so combined in a thousand instances, as in the example already given of a lighter dragged by two horses pulling in different directions. Experiment even shows, that this composition follows precisely the same rule as the composition of the forces which are measured by the velocities; for if the point A (fig. 1) be pulled by a thread or pressed by a spring in the direction AB, and by another in the direction AC, and if the pressures are proportional to AB and AC, then it will be withheld from moving, if it be pulled or pressed by a third force, acting in the direction Ad, opposite to AD, the pressure being also proportional to AD. This force acting in the direction Ad, would certainly withstand an equal force acting in the direction AD; therefore we must conclude that the two pressures AB and AC really generate a force AD. This uniform agreement shows that the composition is deducible from fixed principles; but it does not appear that it can be held as demonstrated by the arguments employed in the case of motions. A demonstration of the composition of pressures is farther

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wanted, in order to render mechanics a demonstrative science.

Accordingly, philosophers of the first eminence have turned their attention to this problem. It is by no means easy; being so nearly allied to first principles, that it must be difficult to find axioms of greater simplicity by which it may be proved.

Mechanicians generally contented themselves with the solution given by Aristotle; but this is merely a composition of motions; indeed he does not give it for any thing else, and calls it *συνθεσις τῶν φη αὐν*. The first writer who appears to have considered it as different from the mere composition of motions, was the celebrated Dutch engineer Stevinus, in his work on *Sluices*; but his solution is obscure. It was sufficient, however, to convince Daniel Bernoulli of the necessity and the difficulty of the problem. He has given the first complete demonstration of it in the first volume of the commentaries of the Imperial Academy of Sciences at St Petersburg. It is extremely ingenious; but it is tedious and intricate, requiring a series of fifteen propositions to demonstrate that two pressures, having the directions and magnitudes of the sides of any parallelogram, compose a third, which has the direction and magnitude of its diagonal. His first proposition is, that *two equal pressures, acting at right angles, compose a third, in the direction of the diagonal of a square, and having to either of the other two the proportion of the diagonal of a square to its sides*.

M. d'Alembert has greatly simplified and improved this demonstration, by beginning with a case that is self-evident; namely, *if three equal forces are inclined to each other in equal angles of 120° , any one of them will balance the combined action of the other two*. Surely; for neither of them can prevail. Therefore *two equal forces, inclined in an angle of 120° , produce a third, which has the direction and proportion of the diagonal of the rhombus*; for this is equal and opposite to one of the three above mentioned. He then demonstrates the same thing of two equal forces inclined in *any* angle; and by a series of eight propositions more, demonstrates the general theorem. This dissertation is in the *Memoirs of the Academy at Paris* for 1769. He improves it still farther in a subsequent memoir.

Mr Riccati and Mr Fonsenex, in the *Commentaries of the Academy of Turin*, have given analytical demonstrations, which are also very ingenious and concise, but require acquaintance with the higher mathematics. There is another very ingenious demonstration in the *Journal des Sçavans* for June 1764, but too obscure for an elementary proposition. It is somewhat simplified by Belidor in his *Ingenieur François*. Frisius, in his *Cosmographia*, has given one, which is perhaps the best of all those that are easily comprehended without acquaintance with the higher mathematics; but we imagine that, although no one can doubt of the conclusion, it has not that intuitive evidence for every step of the process that seems necessary.

Composi-
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50. We here offer another, composed by blending together the methods of Bernoulli and D'Alembert; and we imagine that no objection can be made to any step of it. We limit it entirely to pressures, and do not at all consider nor employ the motions which they may be supposed to produce.

(A.) If two equal and opposite pressures or incitements to motion act at once on a material particle, it suffers no change of motion; for if it yields in either direction by their joint action, one of the pressures prevails, and they are not equal.

Equal and opposite pressures are said to *balance* each other; and such a balance must be esteemed equal and opposite.

(B.) If a and b are two magnitudes of the same kind,

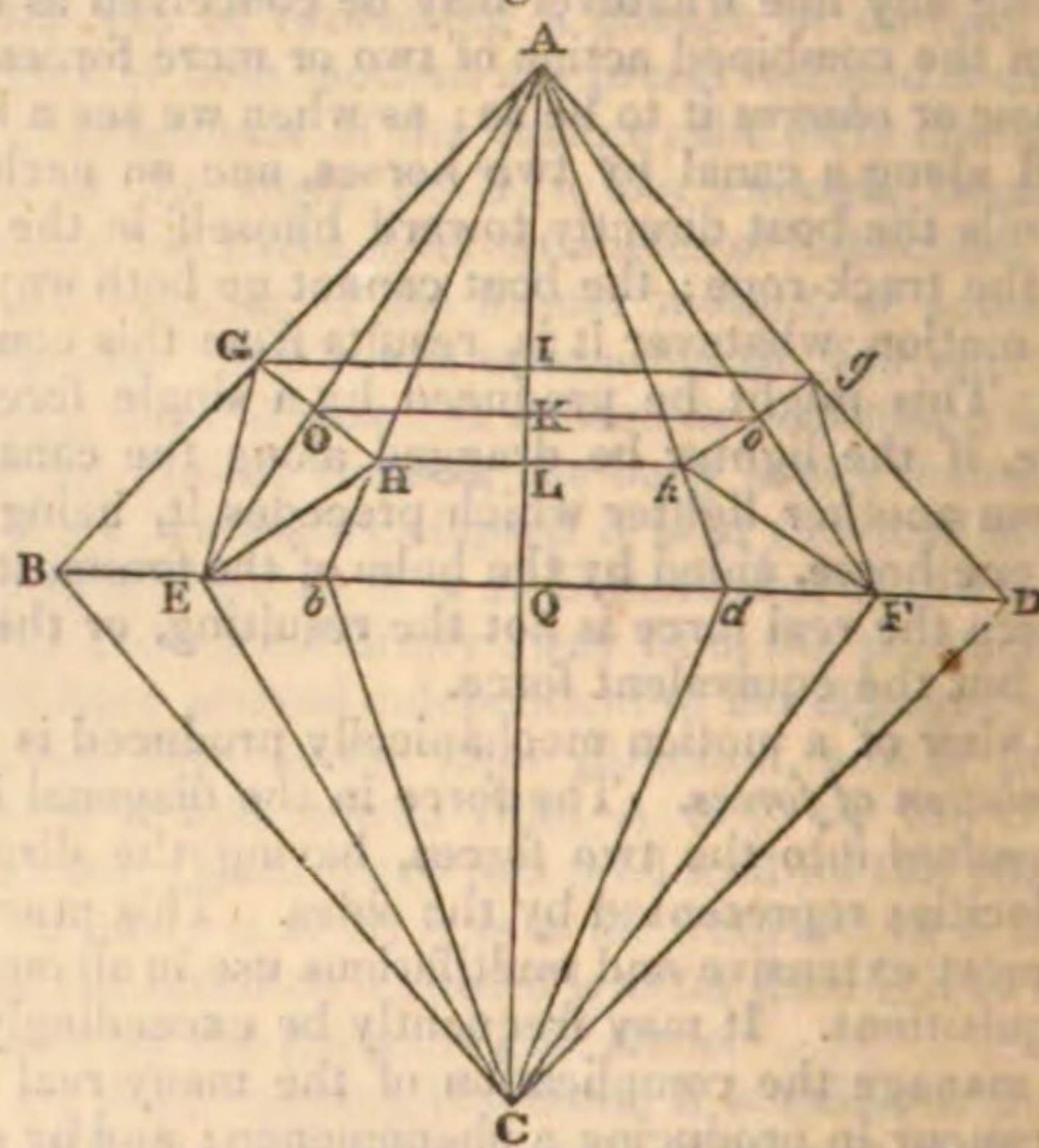
proportional to the intensities of two pressures which act in the same direction, then the magnitude $a + b$ will measure the intensity of the pressure, which is equivalent, and may be called equal to the combined effort of the other two; for when we try to form a notion of pressure as a measurable magnitude, distinct from motion or any other effect of it, we find nothing that we can measure it by but another pressure. Nor have we any notion of a double or triple pressure different from a pressure that is equivalent to the joint effort of two or three equal pressures. A pressure a is accounted triple of a pressure b , if it balances three pressures, each equal to b , acting together. Therefore, in all proportions which can be expressed by numbers, we must acknowledge the legitimacy of this measurement; and it would surely be affectation to omit those which the mathematicians call *incommensurable*.

In like manner, the magnitude $a - b$ must be acknowledged to measure that pressure which arises from the joint action of two pressures a and b acting in opposite directions, of which a is the greatest.

(C.) Let ABCD and AbCd (fig. 2) be two rhombuses, which have the common diagonal AC. Let the angles BAb, DAd, be bisected by the straight lines AE and AF.

If there be drawn from the points E and F the lines EG, EH, Fg, Fh, making equal angles on each side of EA and FA, and if Gg, Hh be drawn, cutting the diagonal AC in I and L: then $AI + AL$ will be greater or less than AQ, the half of AC, according as the angles GEH, gFh, are greater or less than GAH, gAh.

Fig. 2.



Draw GH, gh, cutting AE, AF, in O and o, and draw Oo, cutting AC in K.

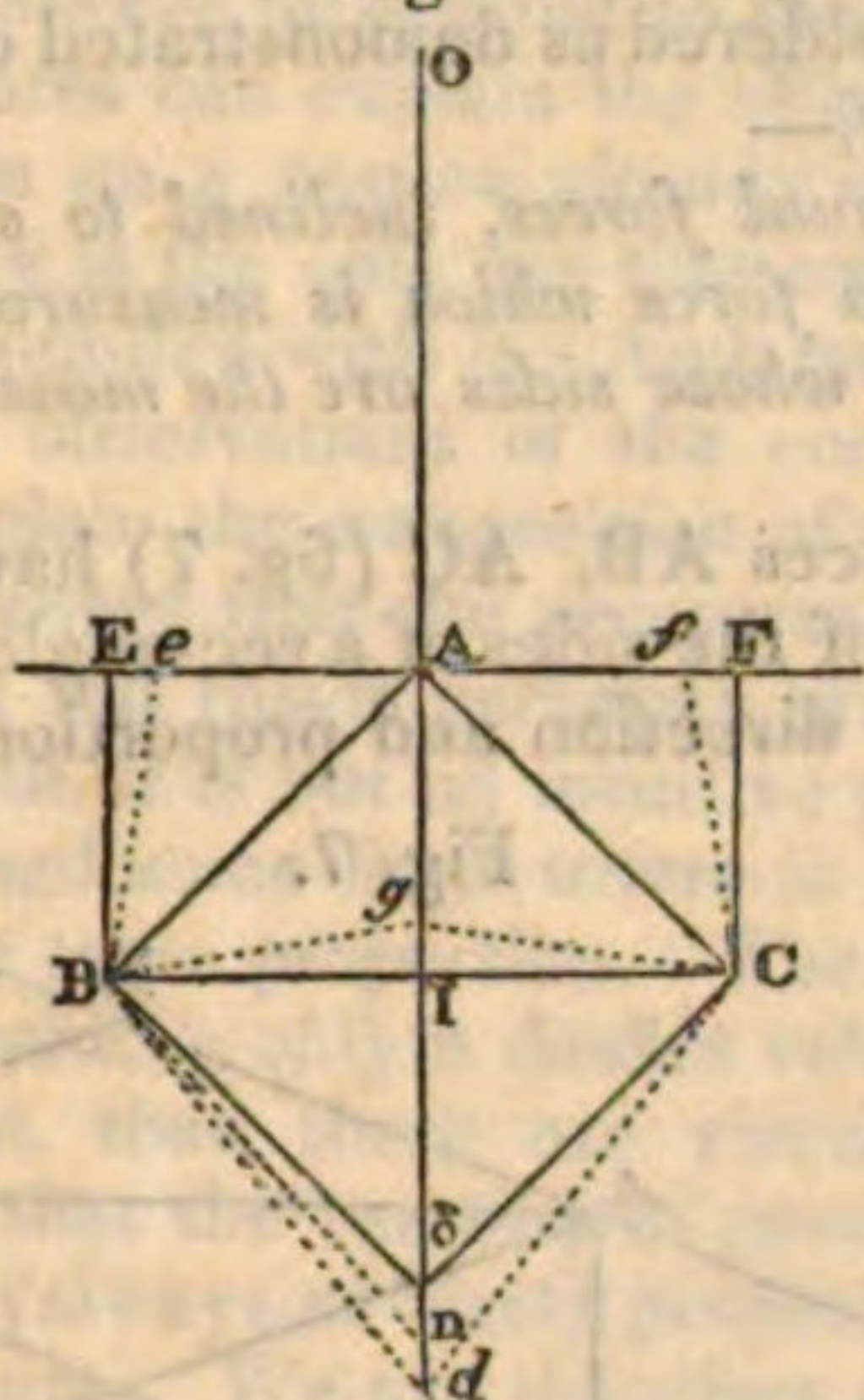
Because the angles AEG and EAG are respectively equal to AEH and EAH, and AE is common to both triangles, the sides AG, GE, are respectively equal to AH, HE, and GH is perpendicular to AE, and is bisected in O; for the same reasons gh is bisected in o. Therefore the lines Gg, Oo, Hh, are parallel, and IL is bisected in K. Therefore $AI + AL$ is equal to twice AK. Moreover, if the angle GEH be greater than GAH, AO is greater than EO, and AK is greater than KQ. Therefore $AI + AL$ is greater than AQ; and if the angle GEH be less than GAH, $AI + AL$ is less than AQ.

(D.) Two equal pressures, acting in the directions AB and AC (fig. 3), at right angles to each other, compose a pressure in the direction AD, which bisects the right angle; and its intensity is to the intensity of each of the constituent pressures as the diagonal of a square to one of the sides.

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Fig. 3.



It is evident, that the direction of the pressure, generated by their joint action, will bisect the angle formed by their directions; because no reason can be assigned for the direction inclining more to one side than to the other.

In the next place, since a force in the direction AD does, in fact, arise from the joint action of the equal pressures AB and AC, the pressure AB may be conceived as arising from the joint action of two equal forces similarly inclined and proportioned to it. Draw EAF perpendicular to AD. One of these forces must be directed along AD, and the other along AE. In like manner, the pressure AC may arise from the joint action of a pressure in the direction AD, and an equal pressure in the direction AF. It is also plain that the pressures in the directions AE and AF, and the two pressures in the direction AD, must be all equal. And also, any one of them must have the same proportion to AB or to AC, that AB or AC has to the force in the direction AD, arising from their joint action.

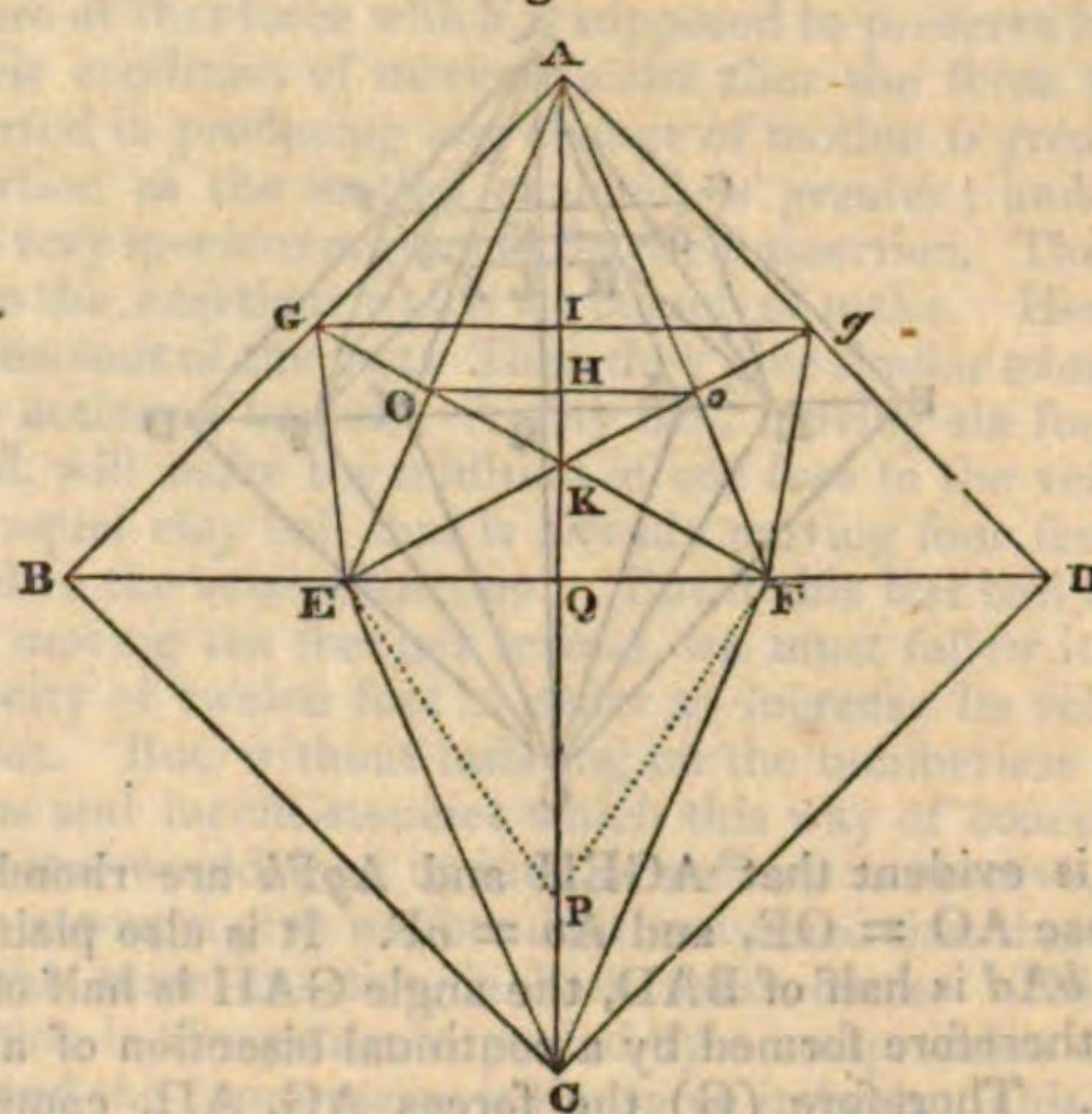
Therefore, if it be said that AD does not measure the pressure arising from the joint action of AB and AC, let *Ad*, greater than AD, be its just measure, and make $Ad : AB = AB : Ag = AB : Ae$. Then *Ag* and *Ae* have the same inclination and proportion to AB that AB and AC have to *Ad*. We determine, in like manner, two forces *Af* and *Aq* as constituents of AC.

Now Ad is equivalent to AB and AC , and AB is equivalent to Ae and Ag ; and AC is equivalent to Af and Ag . Therefore Ad is equivalent to Ae , Af , Ag , and Ag . But (A) Ae and Af balance each other, or annihilate each other's effect; and there remain only the two forces or pressures Ag , Ag . Therefore (B) their measure is a magnitude equal to twice Ag . But if Ad be greater than the diagonal AD of the square, whose sides are AB and AC ; then Ag must be less than AI , the side of the square whose diagonal is AB . But twice Ag is less than AD , and much less than Ad . Therefore the measure of the equivalent of AB and AC cannot be a line Ad , greater than AD . In like manner, it cannot be a line $A\delta$ that is less than AD . Therefore it must be equal to AD , and the proposition is demonstrated.

(E.) *Cor.* Two equal forces, AB, AC, acting at right angles, will be balanced by a force AO, equal and opposite to AD, the diagonal of the square whose sides are AB and AC; for AO would balance AD, which is the equivalent of AB and AC.

(F.) Let AECF (fig. 4), be a rhombus, the acute angle of which, EAF, is half of a right angle. Two equal pressures, which have the directions and measures AE, AF, compose a pressure having the direction and measure AC, which is the diagonal of the rhombus.

Fig. 4.



It is evident, in the first place, that the compound force has the direction AC, which bisects the angle EAF. If AC be not its just measure, let it be AP less than AC. Let ABCD be a square described on the same diagonal, and make $AP : AQ = AE : AO, = AF : Ao$. Draw KOG, Kog perpendicular to AE, AF; draw GIg, OHo, EG, EK, Fg, FK, PF, and PE.

The angles CAB and FAE are equal, each being half of a right angle. Also the figures AEPF and AGEK are similar; because $AP : AQ = AE : AO$. Therefore $FA : AP = KA : AE$, and $EA : AP = GA : AE$. Therefore, in the same manner that the forces AE, AF are affirmed to compose AP, the forces AG and AK may compose the force AE, and the forces Ag and AK may compose the force AF. Therefore (B) the force AP is equivalent to the four forces AG, AK, Ag, AK. But (D) AG and Ag are the sides of a square, whose diagonal is equal to twice AI; and the two forces AK, AK are equal to, or are measured by, twice AK. Therefore the four forces AG, AK, Ag, AK, are equivalent to $2 AI + 2 AK = 4 AH$.

But because AP was supposed less than AC, the angle FPE is greater than FAE, and GEK is greater than GAK, AO is greater than OE, and AH is greater than HQ, and 2AH is greater than AQ; and therefore 4AH is greater than AC, and much greater than AP. Therefore AP is not the just measure of the force composed of AE and AF.

In like manner it is shown that AE and AF do not compose a force whose measure is greater than AC. It is therefore equal to AC; and the proposition is demonstrated.

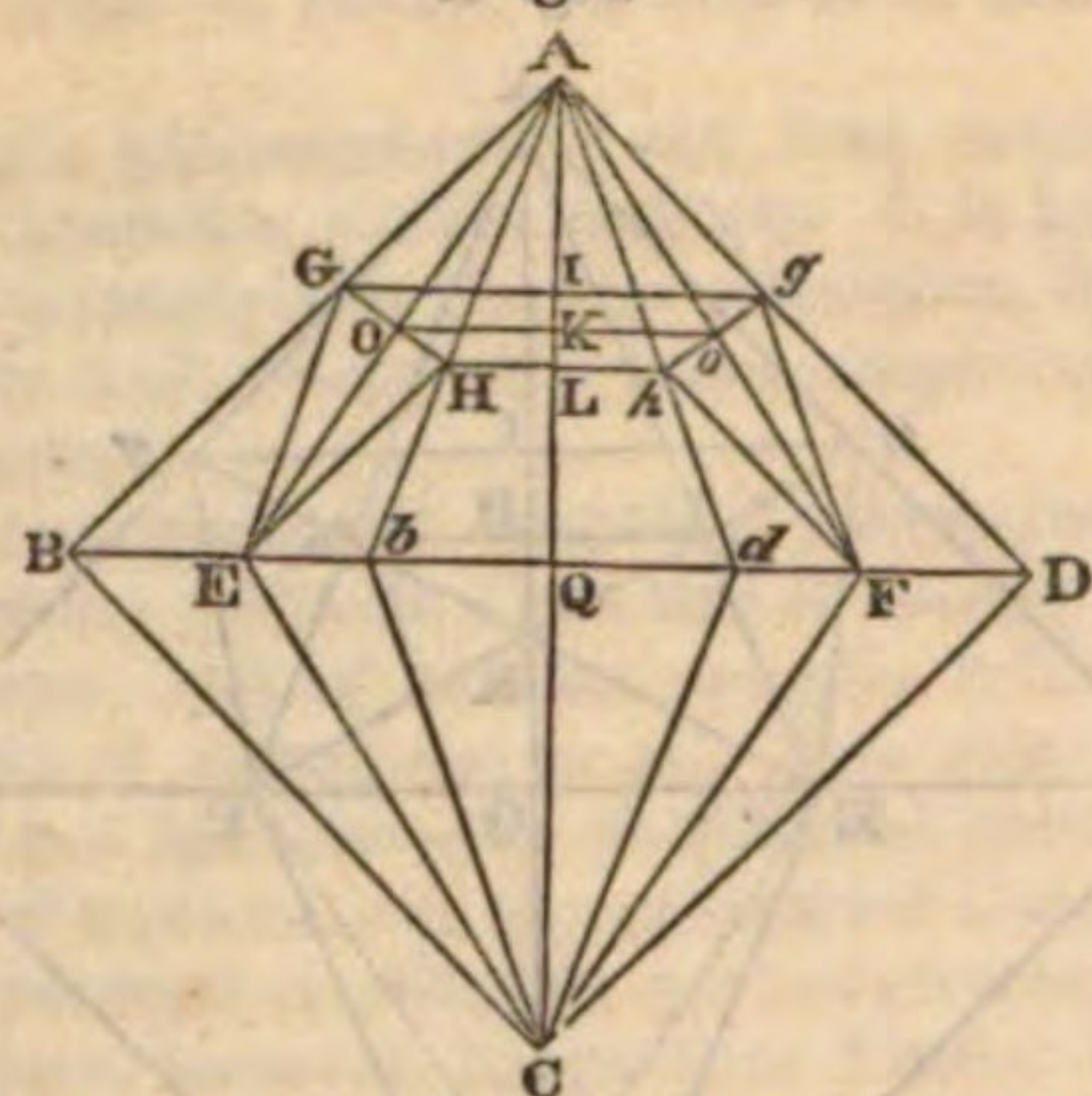
(G.) By the same process it may be demonstrated, that if BAD be half a right angle, and EAF be the fourth of a right angle, two forces AE, AF will compose a force measured by AC. And the process may be repeated for a rhombus, whose acute angle is $\frac{1}{8}$ th, $\frac{1}{10}$ th, &c. of a right angle; that is, any portion of a right angle that is produced by continual bisection. Two forces, forming the sides of such a rhombus, compose a force measured by the diagonal.

(H.) Let $ABCD$, $AbCd$, (fig. 5), be two rhombuses, formed by two consecutive bisections of a right angle. Let $AECF$ be another rhombus, whose sides AE and AF bisect the angles BAb and $DA d$.

The two forces AE , AF , compose a force AC .
Bisect AE and AF in O and o . Draw the perpendiculars GOH , goh , and the lines GIg , OKo , HLh , and the lines EG , EH , Fg , Fh .

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Fig. 5.



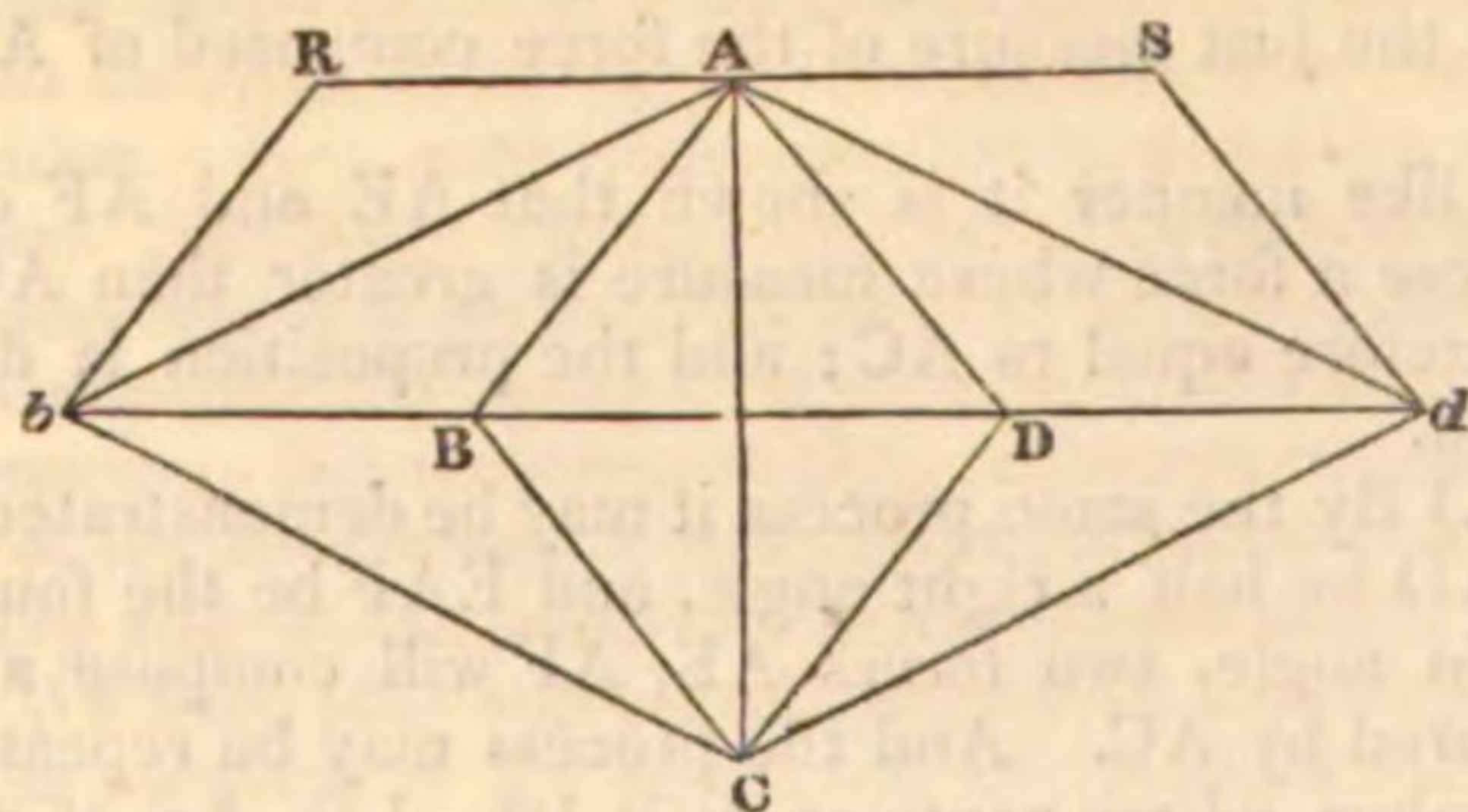
It is evident that AGEH and AgFh are rhombuses; because $AO = OE$, and $AO = OF$. It is also plain, that since bAd is half of BAD , the angle GAH is half of bAd . It is therefore formed by a continual bisection of a right angle. Therefore (G) the forces AG, AH, compose a force AE; and Ag, Ah, compose the force AF. Therefore the forces AG, AH, Ag, Ah, acting together, are equivalent to the forces AE, AF, acting together. But AG, Ag compose a force $= 2 AI$; and the forces AH, Ah compose a force $= 2 AL$. Therefore the four forces acting together are equivalent to $2 AI + 2 AL$, or to $4 AK$. But because AO is $\frac{1}{2} AE$, and the lines Gg, Oo, Hh, are evidently parallel, $4 AK$ is equal to $2 AQ$, or to AC ; and the proposition is demonstrated.

(I.) Cor. Let us now suppose that by continual bisection of a right angle we have obtained a very small angle a of a rhombus; and let us name the rhombus by the multiple of a , which forms its acute angle.

The proposition (G) is true of a , $2a$, $4a$, &c. The proposition (H) is true of $3a$. In like manner, because (G) is true of $4a$ and $8a$, proposition (H) is true of $6a$; and because it is true of $4a$, $6a$, and $8a$, it is true of $5a$ and $7a$. And so on continually till we have demonstrated it of every multiple of a that is less than a right angle.

(K.) Let RAS (fig. 6) be perpendicular to AC, and let ABCD be a rhombus, whose acute angle BAD is some multiple of $2a$ that is less than a right angle. Let Ab, Cd be another rhombus, whose sides Ab, Ad bisect the angles RAB, SAD. Then the forces Ab, Ad compose a force AC.

Fig. 6.



Draw bR, dS parallel to BA, DA. It is evident that ARbB and ASdD are rhombuses, whose acute angles are multiples of a , that are each less than a right angle. Therefore (I) the forces AR and AB compose the force Ab and AS, AD compose Ad; but AR and AS annihilate each other's effect, and there remains only the forces AB, AD. Therefore Ab and Ad are equivalent to AB and AD, which compose the force AC; and the proposition is demonstrated.

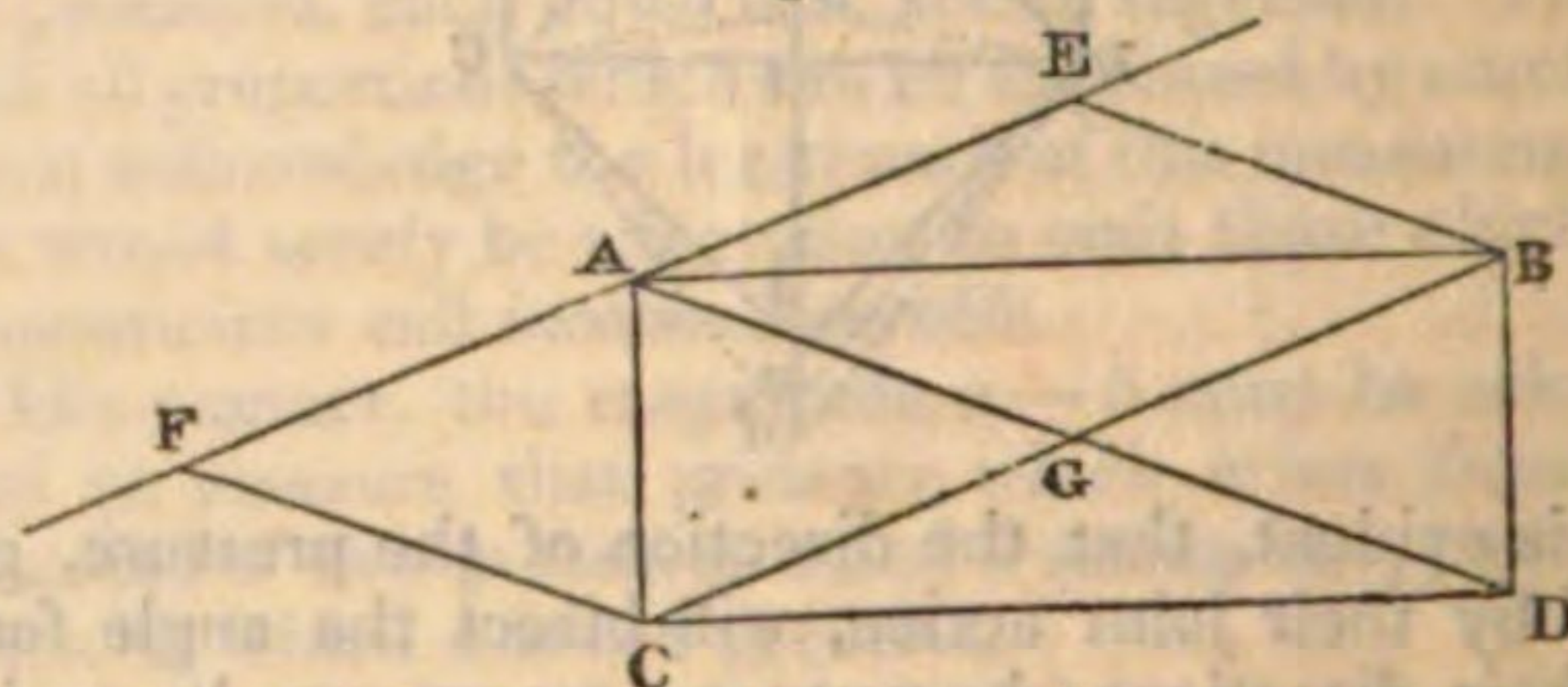
(L.) Cor. Thus is the corollary of last proposition extended to every rhombus, whose angle at A is some multiple of a less than two right angles. And since a may be

taken less than any angle that can be named, the proposition may be considered as demonstrated of every rhombus; and we may say,—

(M.) Two equal forces, inclined to each other in any angle, compose a force which is measured by the diagonal of the rhombus, whose sides are the measures of the constituent forces.

(N.) Two forces AB, AC (fig. 7) having the direction and proportion of the sides of a rectangle, compose a force AD, having the direction and proportion of the diagonal.

Fig. 7.

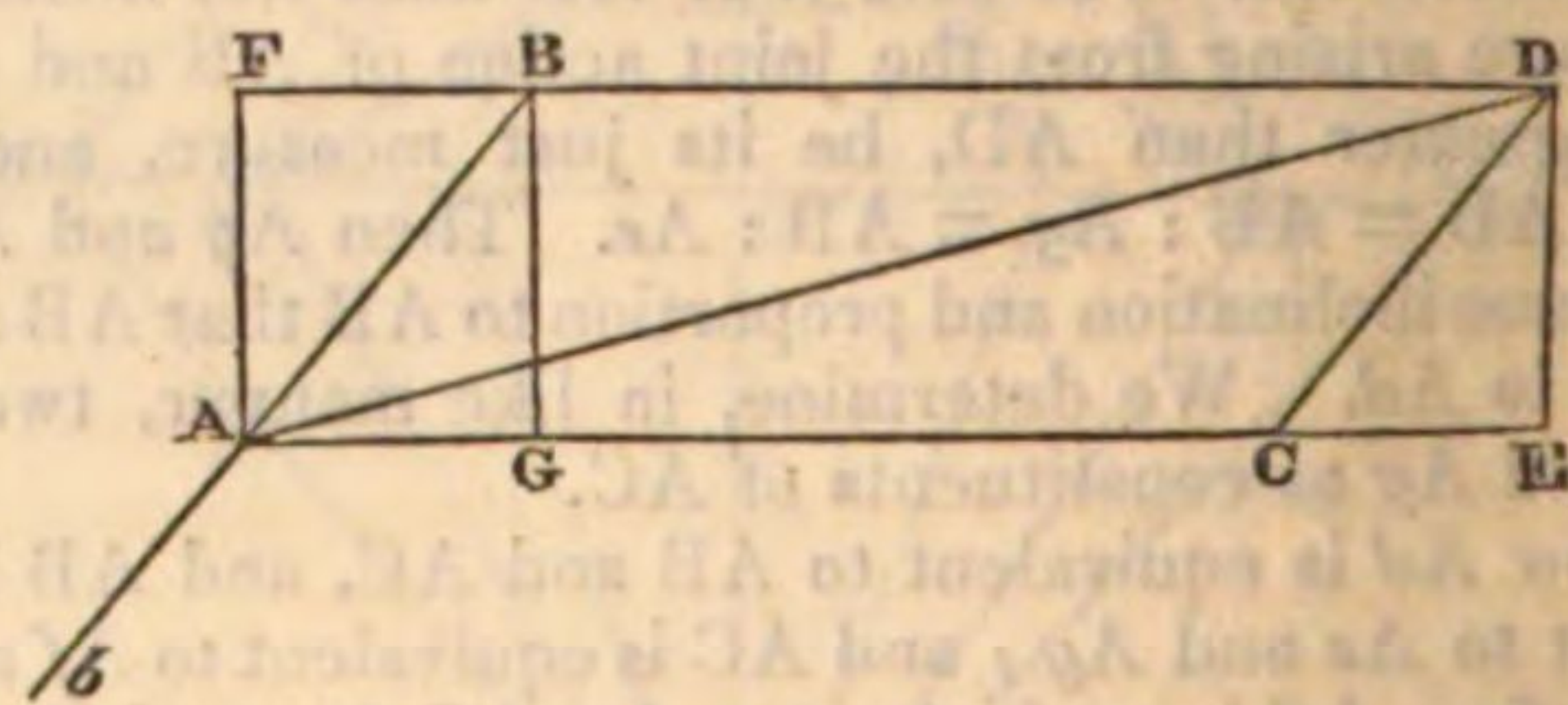


Draw the other diagonal CB, and draw EAF parallel to it: draw BE, CF parallel to DA.

AEBG is a rhombus; and therefore the forces AE and AG compose the force AB. AFCG is also a rhombus, and the force AC is equivalent to AF and AG. Therefore the forces AB and AC, acting together, are equivalent to the forces AE, AF, AG, and AG acting together, or to AE, AF, and AD acting together; but AE and AF annihilate each other's action, being opposite and equal (for each is equal to the half of BC). Therefore AB and AC acting together are equivalent to AD, or compose the force AD.

(O.) Two forces, which have the direction and proportions of AB, AC (fig. 8) the sides of any parallelogram, compose a force having the direction and proportion of the diagonal AD.

Fig. 8.



Draw AF perpendicular to BD, and BG and DE perpendicular to AC.

Then AFBG is a rectangle, as is also AFDE; and AG is equal to CE. Therefore (N) AB is equivalent to AF and AG. Therefore AB and AC acting together, are equivalent to AF, AG, and AC acting together; that is, to AF and AE acting together; that is (N) to AD; or the forces AB and AC compose the force AD.

51. Hence arises the most general proposition.

If a material particle be urged at once by two pressures or incitements to motion, whose intensities are proportional to the sides of any parallelogram, and which act in the directions of those sides, it is affected in the same manner as if it were acted on by a single force, whose intensity is measured by the diagonal of the parallelogram, and which acts in its direction: Or, two pressures, having the direction and proportion of the sides of a parallelogram, generate a pressure having the direction and proportion of the diagonal.

52. Thus have we endeavoured to demonstrate from abstract principles the perfect similarity of the composition of pressures, and the composition of forces measured by the motions which they produce. We cannot help being of the opinion that a separate demonstration is indispen-

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sably necessary. What may be fairly deduced from the one case cannot always be applied to the other. No composition of pressures can explain the change produced by a deflecting force on a motion already existing; for the changing pressure is the only one that exists, and there is none to be compounded with it. And, on the other hand, our notions and observations of the composition of motions will not explain the composition of pressures, unless we take it for granted that the pressures are proportional to the velocities; but this is perhaps a gratuitous assumption. At any rate, it is not an intuitive proposition; and we have mentioned some facts where it seems that they do not follow the same proportion. The pressure of four equal springs produces only a double velocity. It would appear, therefore, that there are circumstances which oblige us to say, that the exertion of pressure, as a cause of motion, is not (always at least) proportional to the real measurable pressure. We are therefore anxious to discover in what the difference consists; and in the mean time must allow, that the pressure exerted on a body at rest is different from its exertion in producing motion. We cannot indeed state any immediate comparison between pressure and motion, nor have we any clear conception of the connection between them. It is only by our own sensations of touch that we have any notion of pressure, and it is experience that teaches us that it always accompanies every cause of motion. We can, however, observe the proportions of pressures, and compare them with the proportions of motion. We very often observe them different; and therefore it was indispensably necessary to investigate the laws of combined pressure as we did the laws of combined motion in consequence of pressure. Yet we should err if we hastily asserted that pressures are not proportional to the motions which they produce; all that we are entitled to call in doubt is, whether the pressures in their exertion, while they actually produce motion, or changes of motion, continue to be the same as when they do not produce motion, being withstood or balanced by opposite pressures. Considered as causes of motion, we ought to think that they do not vary while they produce motion, and that the actual pressure, while it produces a double motion, is really double, although it may be quadruple when the body exerting it is made to act on a body that it cannot move. We are confirmed in this opinion by observing, that other facts show us, that even while producing motion, the pressure which we call quadruple, because we have measured it by four equal pressures balancing it, is really quadruple, considered as the cause of motion, and produces a quadruple motion. A bow which requires four times the force to draw it to any given extent, will communicate the same velocity to a bundle of four arrows that a bow four times more easily drawn communicates to one arrow, and will therefore produce a quadruple motion. Yet it will only produce a double velocity in the arrow that acquired a simple velocity from a bow having one fourth of the strength.

These discrepancies should excite the endeavours of mechanicians to investigate the laws observed in the action of pressures producing motion. Had this been done with care and with candour, we should not have had the great difference of opinion which still divides philosophers about the measures of moving forces. But a spirit of party, which had arisen from other causes, gave importance to what was at first only a difference of expression, and made the partizans of Mr Leibnitz avail themselves of the figurative language which has done so much harm in all the departments of philosophy. Notwithstanding all our caution, it is hardly possible to avoid metaphorical conceptions when we employ the language of metaphor. The abettors of the Leibnitzian measure of moving forces, or perhaps,

to speak more properly, the abettors of the Leibnitzian measure of that force which is supposed to preserve bodies in their condition of motion, insist that the force which is exerted in producing any change of motion is greater in proportion as the motion changed is greater; and they give a very specious argument for their assertion. They appeal to the exertions which we ourselves make. Here we are conscious of the fact. Then they give similar examples of the action of bodies. A clay ball, moving six feet per second, will make the addition of one foot to the velocity of an equal clay ball that is already moving four feet per second in the same direction. But if this last ball be already moving ten feet per second, we must follow it with a velocity of twelve feet in order to increase its velocity one foot. But, without insisting on the numberless paralogisms and inconsistencies which this way of conceiving the matter would lead us into, it suffices to observe, that the phenomena give us abundant assurance that there has been the same exertion in both these cases. This acceleration is always accompanied by a compression of the balls, and the compression is the same in both. This compression is a very good measure of the force employed to produce it; and, in the present case, we need not even trouble ourselves with any rule for its measurement: for surely, when the compression is not different, but the same, the force exerted is the same. This is farther confirmed by observing, that it requires the same force to make the same pit, or to give the same motion, to a piece of clay lying on the table of a ship's cabin, whether the ship be sailing two miles or ten miles per hour.

Thus we see that there are strong reasons for believing, that the exertions of pressure in producing motion, or that the pressures *actually exerted*, are proportional to the changes of motion observed, and that they coincide in this respect with our abstract conceptions of moving forces.

But we have still better arguments. None of the Leibnitzians think of denying the equal exertions of gravity, or of any of those powers which they call *solicitations* or *accelerating forces*. They all admit that gravity, or any constant accelerating force, produces equal increments of velocity in equal times, and that a double gravity will produce a double increment in an equal time, and an equal increment in half of the time: and that a quadruple gravity will produce a double velocity in half the time. All these things are granted by them, and their writings are full of reasonings from this principle. Now, from the fact, acknowledged by the Leibnitzians, that the quadruple force of a bow gives a double velocity to the arrow, in every instant of its action, it indisputably follows, that it has acted on it only for half the time of the action of the four times weaker bow, which gives the arrow only half the velocity; and thus has the discrepancy between the effects of pressures and of our abstract moving forces entirely disappeared. For this circumstance of the difference in the time of acting will be found, on strict examination, in all the cases of the change of motion by pressures which we measure by their effects on a body at rest. When this and the appreciable changes of actual pressure, during the time of producing the motion, are taken into consideration, all difference vanishes, and the composition of pressures is in perfect harmony with the composition of motions, or of abstract moving forces. Dynamics is thus made a demonstrative science, and affords the opportunity of investigating, by observation and experiment, the nature of those mechanical powers which reside in bodies, and which appear to us under the form of pressure, inducing us to consider pressure as a cause of motion.

In this, however, we are rather inaccurate. Pressure is one of the sensible effects of that property which is also

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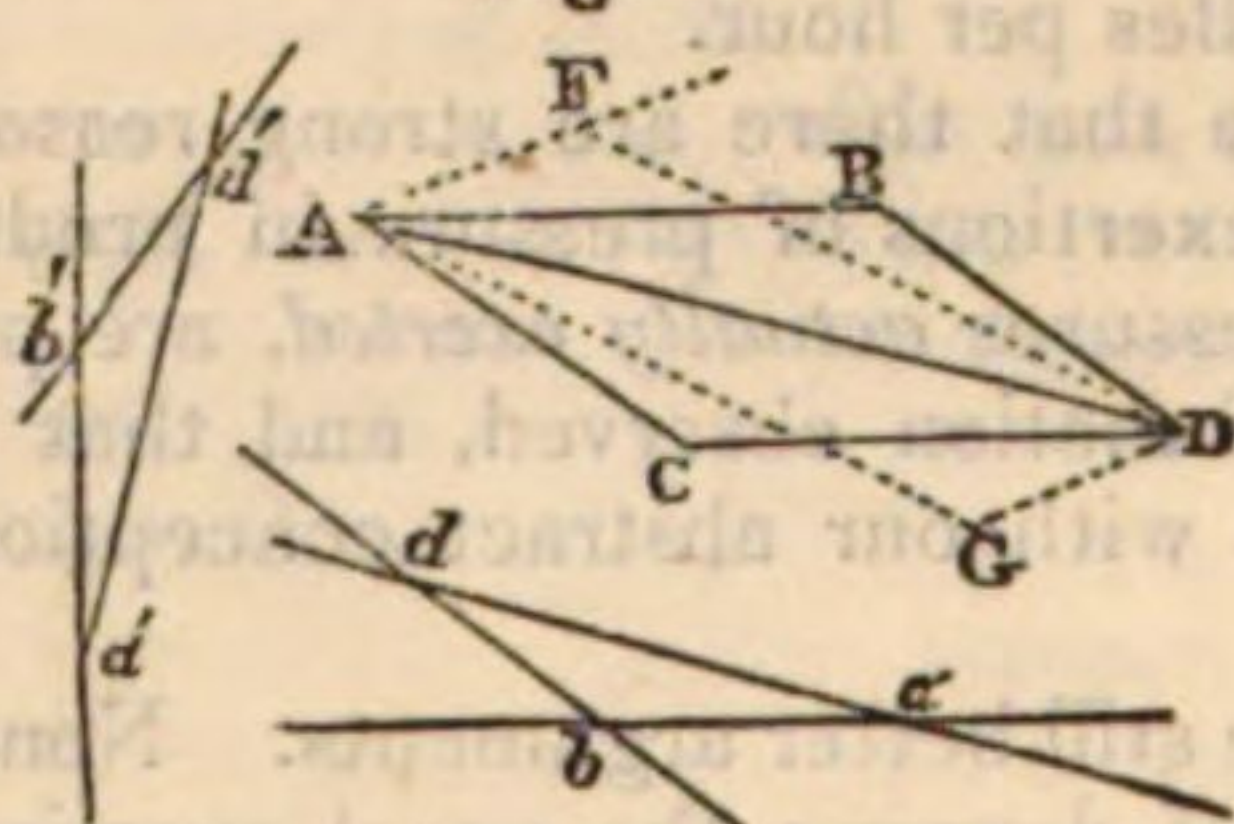
the cause of motion. It is not the pressure of a piece of lead, but its heaviness, that is the reason that it gives motion to a kitchen jack. Pressure is merely a generic name, borrowed from a similar instance, and given to moving forces, which have the same nature, but different names that serve to mark their connection with certain substances, in which they may be supposed to reside. Natural philosophy is almost entirely employed in examining the nature of these various pressures or accelerative forces; and the general doctrines of dynamics, by ascertaining what is common to them all, enable us to mark with precision what is characteristic of each.

General
corollaries.

53. We have now advanced very far in this investigation; for we have obtained the criterion by which we learn the direction and the magnitude of every changing force; and, on the other hand, we see how to state what will be the effect of the exertion of any force that is known or suspected to act. All this we learn by the composition of forces; and the greatest part of mechanical disquisition consists in the application of this doctrine. For such reasons it merits minute consideration; and therefore we must point out some general conclusions from the properties of figure, which will greatly facilitate the use of the parallelogram of forces.

54. *First*, The constituent and the resulting forces, or the simple and compound forces, act in the same plane; for the sides and diagonal of a parallelogram are in one plane.

Fig. 9.



55. *Second*, The simple and the compound forces are proportional to the sides of any triangle which are parallel to their directions. For if any three lines, ab , bd , ad , be drawn parallel to AB , AC , and AD (fig. 9), they will form a triangle similar to the triangle ABD . For the same reasons they are proportional to the sides of a triangle abd , which are respectively perpendicular to their directions.

56. *Third*, Therefore each is proportional to the sine of the opposite angle of this triangle; for the sides of any triangle are proportional to the sines of the opposite angles.

57. *Fourth*, Each is proportional to the sine of the angle contained by the directions of the other two; for AD is to AB as the sine of the angle ABD to the sine of the angle ADB . Now the sine of ABD is the same with the sine of BAC contained between the directions AB and AC , and the sine of ADB is the same with the sine of CAD ; also AB is to AC , or BD , as the sine of ADB (or CAD) to the sine of BAD .

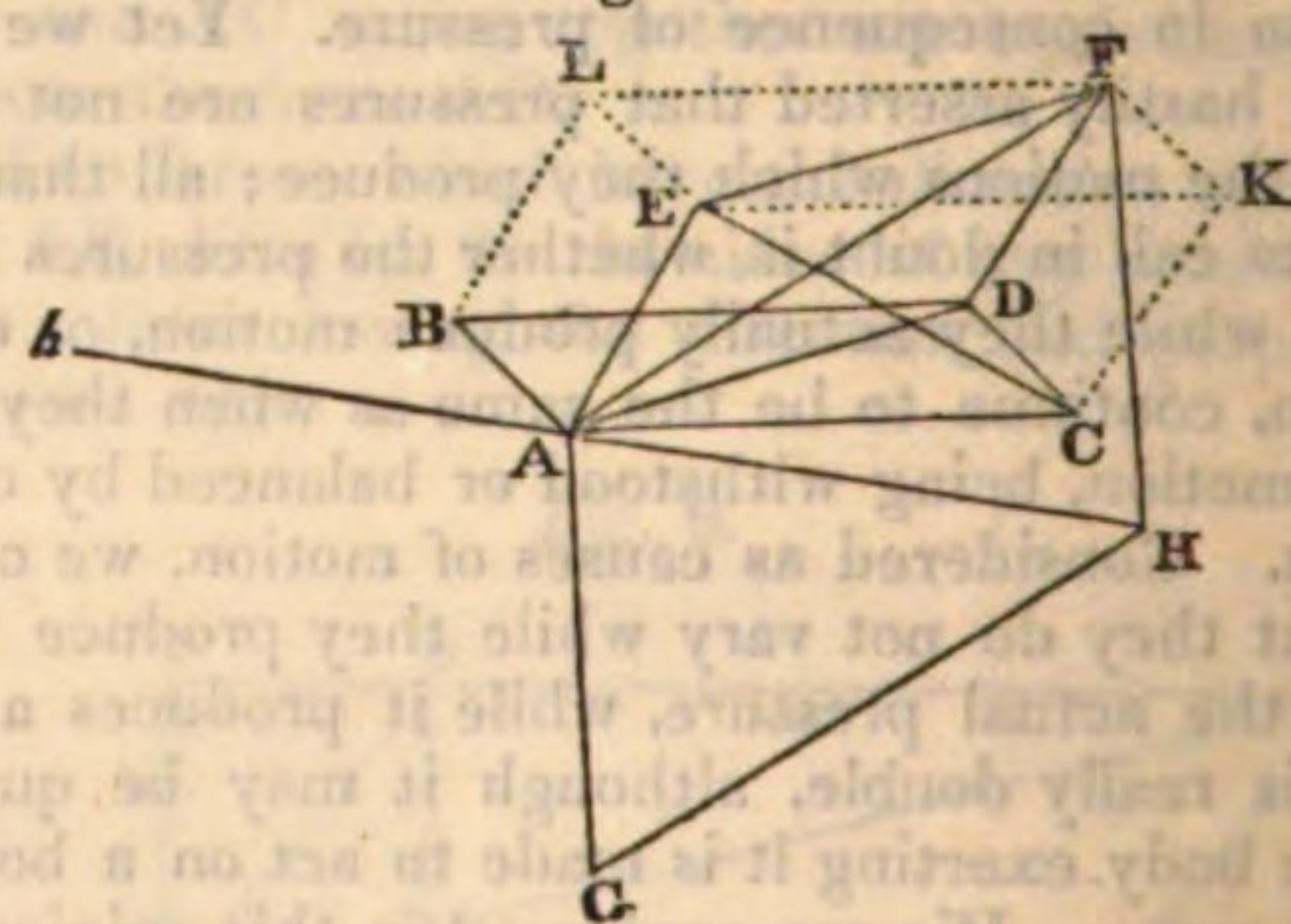
Some spe-
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the paral-
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58. We now proceed to the application of this fundamental proposition. And we observe, in the first place, that since AD may be the diagonal of an indefinite number of parallelograms, the motion or the pressure AD may result from the joint action of many pairs of forces. It may be produced by forces which would separately produce the motions AF and AG . This generally gives us the means of discovering the forces which concur in its production. If one of them, AB , is known in direction and intensity, the direction AC , parallel to BD , and the intensity, are discovered. Sometimes we know the directions of both. Then, by drawing the parallelogram or

triangle, we learn their proportions. The force which deflects any motion AB into a motion AD , is had by simply drawing a line from the point B (to which the body would have moved from A in the time of really moving from A to D) to the point D . The deflecting force is such as would have caused the body move from B to D in the same time. And, in the same manner, we get the compound motion AD , which arises from any two simple motions AB and AC , by supposing both of the motions to be accomplished in succession. The final place of the body is the same, whether it moves along AD or along AB and BD in succession.

59. This theorem is not limited to the composition of two motions or two forces only; for since the combined action of two forces puts the body into the same state as if their equivalent alone had acted on it, we may suppose this to have been the case, and then the action of a third force will produce a change on this equivalent motion. The resulting motion will be the same as if only this third force and the equivalent of the other two had acted on the body. Thus, in fig. 10, the three forces AB , AC , AE , may act at once on a particle of matter. Complete the parallelogram $ABDC$; the diagonal AD is the force which is generated by AB and AC . Complete the parallelogram $AEFD$; the diagonal AF is the force resulting from the combined action of the forces AB , AC , and AE . In like manner, completing the parallelogram $AGHF$, the diagonal AH is the force resulting from the combined action of AB , AC , AE , and AG , and so on of any number of forces.

Fig. 10.



This resulting force and the resulting motion may be much more expeditiously determined, in any degree of composition, by drawing lines in the proportion and direction of the forces in succession, each from the end of the preceding. Thus, draw AB , BD , DF , FH , and join AH ; AH is the resulting force. The demonstration is evident.

60. It is to be noticed here, that in the composition of more than two forces, we are not limited to one plane. The force AD is in the same plane with AB and AC ; but AE may be elevated above this plane, and AG may lie below it. AF is in the plane of AD and AE , and AH is in the plane of AF and AG .

Complete the parallelograms $ABLE$, $ACKE$, $ELFK$. It is evident that $ABLFKCD$ is a parallelopiped, and that AF is one of its diagonals. Hence we derive a more general theorem of great use.

Three forces having the proportion and direction of the three sides of a parallelopiped, compose a force having the proportion and direction of the diagonal.

61. Any number of forces acting together on one particle of matter are balanced by a force that is equal and opposite to their resulting force; for this force would balance their resulting force which is equivalent to them in action. When this is duly considered, we perceive that each force is then in equilibrio with the equivalent of all

Second
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Second
Law of
Motion.

the others; for a force can balance only what is equal and opposite to it. It appears very readily by the geometrical construction. If, instead of the circuit A, B, D, F, H, we take B, D, F, H, A, we have BA for the equivalent of the forces AC, AE, AG; but AB is equal and opposite to BA. Therefore the force AB is in equilibrio with the equivalent of all the others.

62. When any number of forces act on one particle of matter, and are in equilibrio, if they be considered as acting in parcels, the equivalents of these parcels are in equilibrio; for let the forces AB, AC, AE, AG, Ah, be in equilibrio, and let them be considered in the two parcels AB, AC, and AE, AG, Ah, then AD is the equivalent of AB, BD (or AC), and DA is the equivalent of DF, FH, HA (or Ah): now AD and DA balance each other. This corollary enables us to simplify many intricate complications of force; it also enables us to draw accurate conclusions from very imperfect observations. In most of our practical discussions we know, or at least we attend to, a part only of the forces which are acting on a material particle; and in such cases we reason as if we saw the whole: yet is our mathematical reasoning good with respect to the equivalent of all the parcels which we are contemplating, and the equivalents of the smaller parcels of which it consists; and the neglected force, or parcel of forces, induces no error on our conclusions.

Expedi-
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the result-
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in compli-
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63. In the spontaneous phenomena of nature, the investigation and discovery of our ultimate object of search is frequently very difficult, on account of the multiplicity of directions and intensities of the operating forces or motions. We may generally facilitate the process, by substituting equivalent forces or motions acting in convenient directions. It is in this way that the navigator computes the ship's place with very little trouble, by substituting equivalent motions in the meridional and equatorial directions for the real oblique courses of the ship. Instead of setting down ten miles on a course, S. $36^{\circ} 52'$ W. he supposes that the ship has sailed eight miles due south, and six miles due west, which brings her near to the same place. Then, instead of fourteen miles south-west, he sets down ten miles south and ten miles west; and he proceeds in the same way for every other course and distance. He does this expeditiously by means of a traverse table, in which are ready calculated the meridional and equatorial sides of right-angled triangles, corresponding to every course and distance. Having done this for the course of a whole day, he adds all the southings into one sum, and all the westings into another; he considers these as forming the sides of a right-angled triangle; he looks for them, paired together, in his traverse table, and then notices what angle and what distance corresponds to this pair. This gives him the position and magnitude of the straight line joining the beginning and end of his day's work.

The miner proceeds in the same way when he takes the plan of subterraneous workings, measuring, as he goes along, and noticing the bearing of each line by the compass, and setting down, from his traverse table, the northing or southing, and the easting or westing, for each oblique line: but there is another circumstance which he must attend to, namely, the slope of the various drifts, galleries, and other workings. This he does by noting the rise or the dip of each sloping line. He adds all these into two sums, and taking the risings from the dips, he obtains the whole dip. Thus he learns how far the workings proceed to the north, how far to the east, and how far to the dip.

The reflecting reader will perceive that the line joining the two extremities of this progression will form the diagonal of a rectangular parallelopiped; one of whose sides

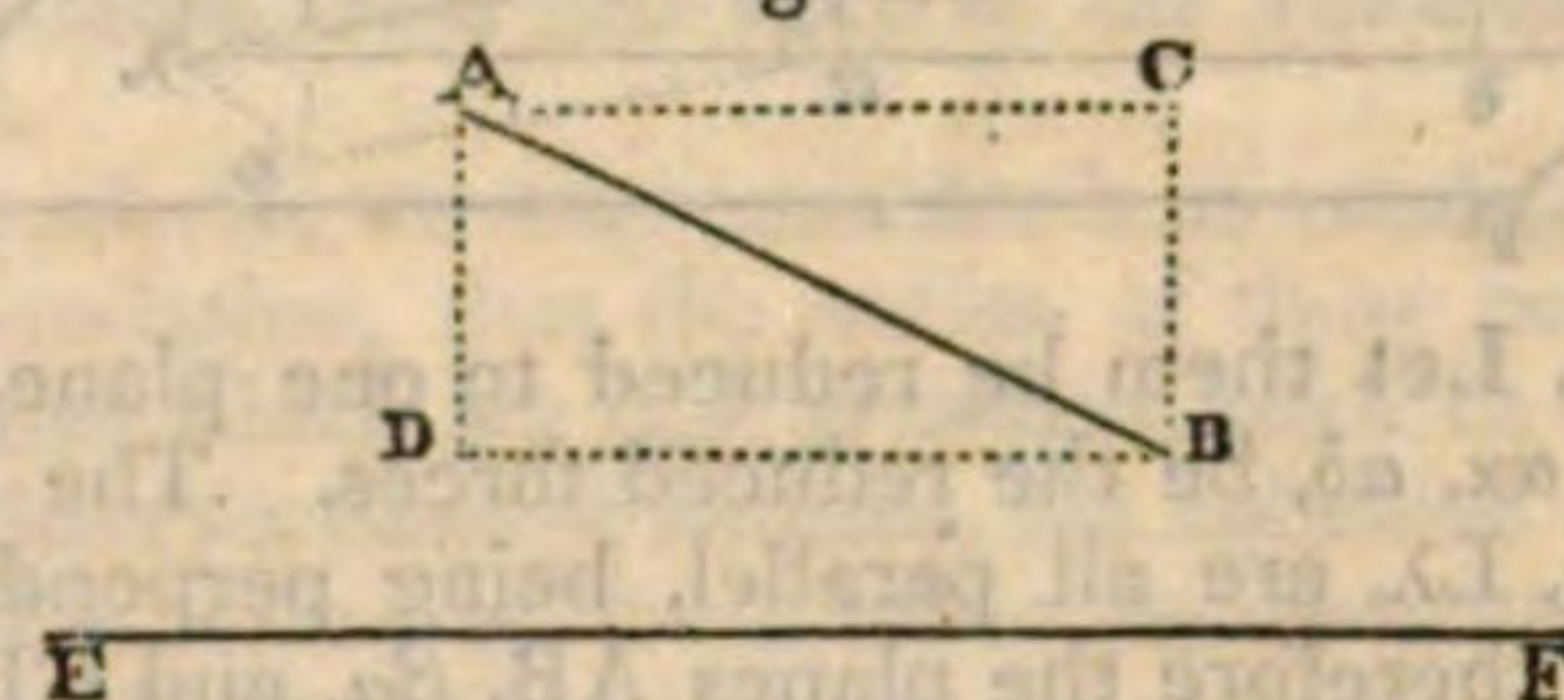
lies north and south, the other lies east and west, and the third is right up and down.

The mechanician proceeds in the very same way in the investigation of the very complicated phenomena which frequently engage his attention. He considers every motion as compounded of three motions in some convenient directions, at right angles to each other. He also considers every force as resulting from the joint action of three forces, at right angles to each other, and takes the sum or difference of these in the same or opposite directions. From this process he obtains the three sides of a parallelopiped, and from these computes the position and magnitude of the diagonal. This is the motion or force resulting from the composition of all the partial ones.

This procedure is called the *estimation* or *reduction* of Forces motions and forces.

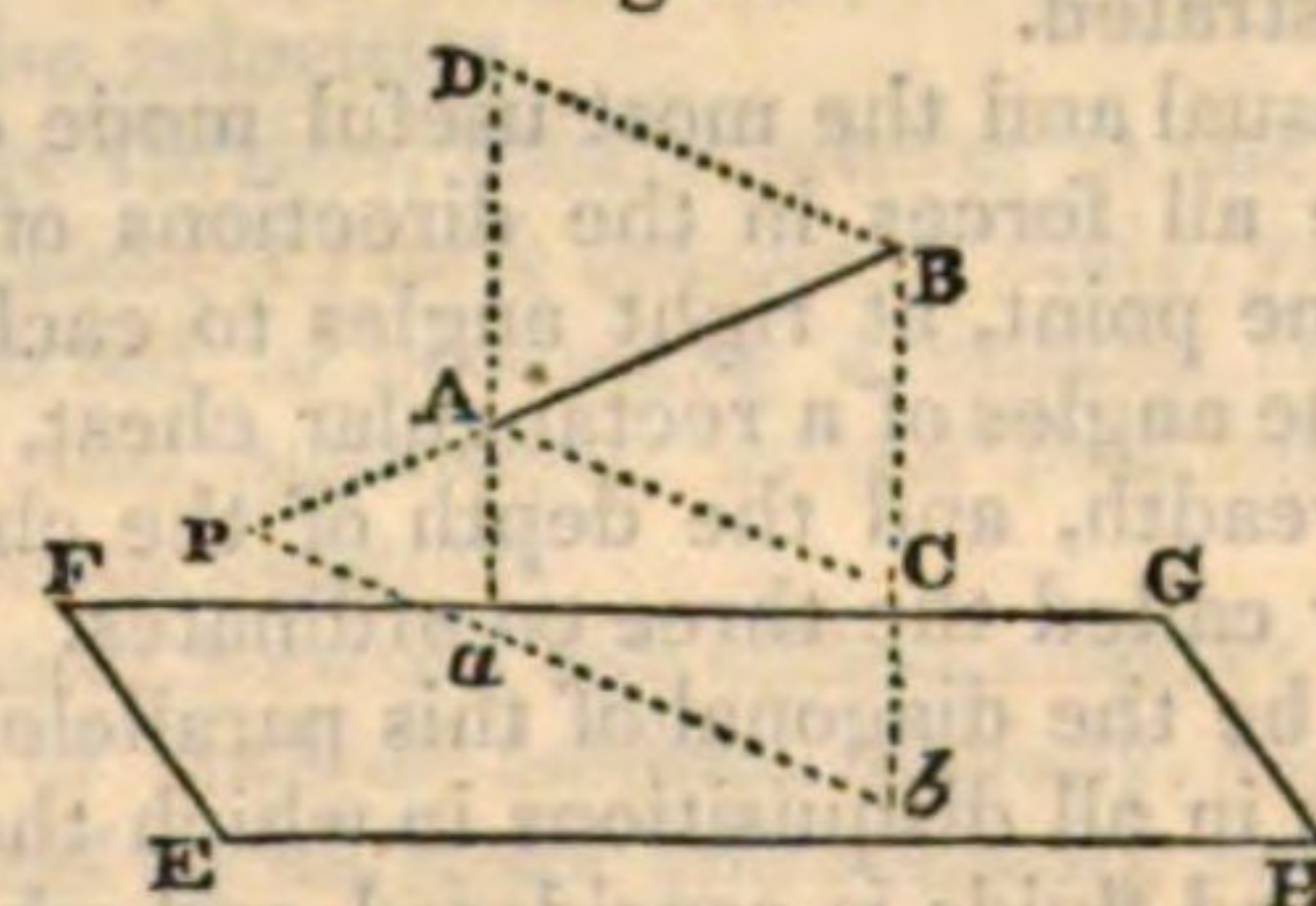
Forces
may be
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by, or re-
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Fig. 11.



64. A motion or force AB (fig. 11) is said to be *estimated* in a given direction, or to be *reduced* to this direction when it is conceived as compounded of the motions or forces AC, AD, one of which, AC, is parallel to EF, and the other, AD, is perpendicular to it. This expression is abundantly significant; for it is plain that the motion AD neither promotes nor hinders the progress along EF, and that AC expresses the whole progress in this direction.

Fig. 12.



65. In like manner, a force AB (fig. 12) is said to be *estimated in*, or *reduced to*, a given plane EFG when it is conceived as resulting from the joint action of two forces AC, AD, one of which is parallel to a line *ab* drawn in that plane, and the other AD is perpendicular to it. The position of the line *ab* is determined by letting fall Bb perpendicular to the plane, and drawing Bp to the point P, in which BA meets the plane; then Aa being drawn parallel to Bb, will cut off *ba*, which is the reduction of the motion AB to the plane. Drawing AC parallel to *ab*, and completing the parallelogram ACBD, it is evident that the motion AB is equivalent to AD and AC, which is parallel to *ab*, and the three forces AB, AC, AD, are, as they should be, in one plane perpendicular to the plane EG.

66. If three forces AB, AC, AD (fig. 13) are in equilibrio, and are reduced to any one direction *dAl*, or to one plane EFGH, the reduced forces are also in equilibrio.

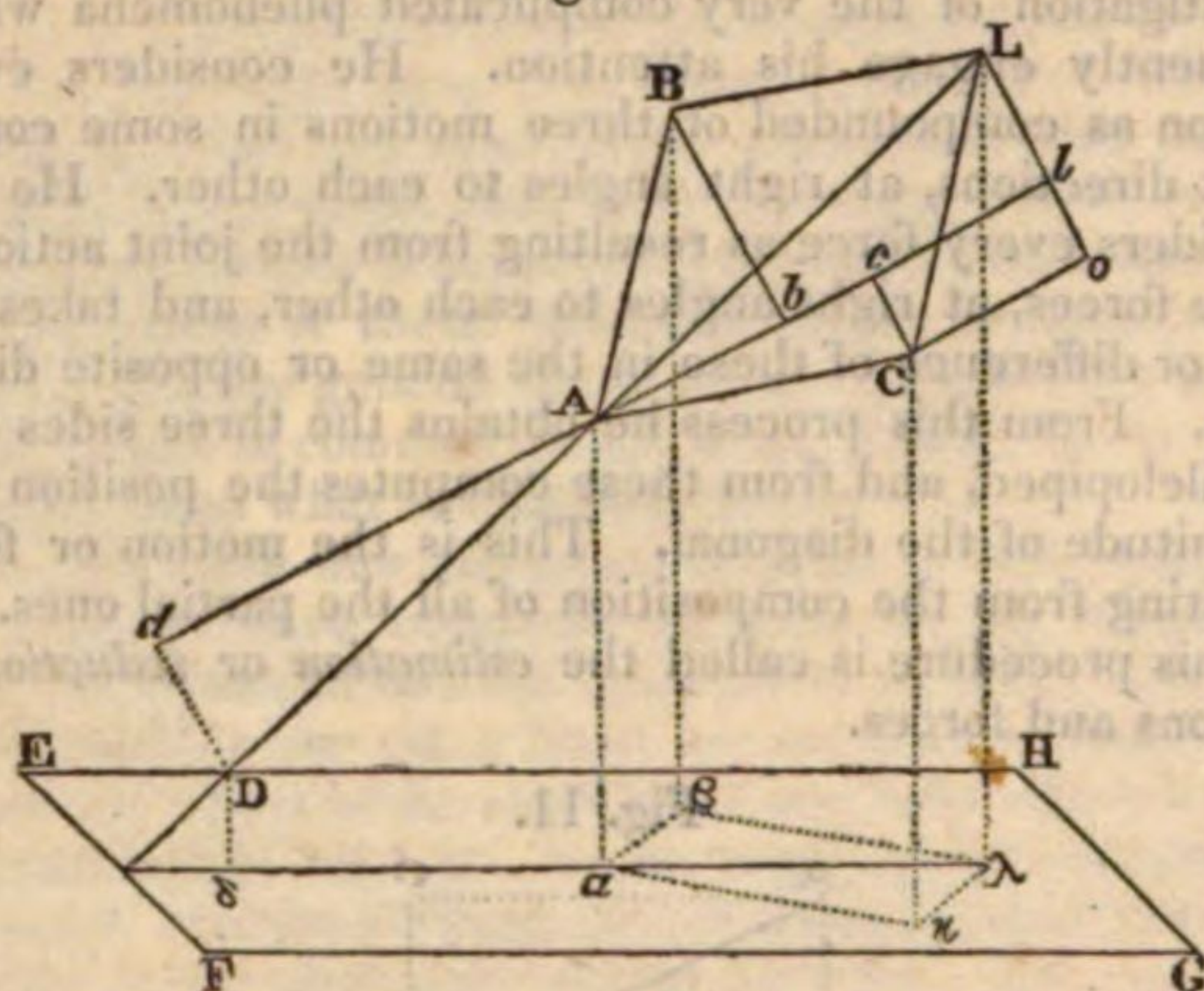
First, let them be reduced to one direction *dl* by drawing the perpendiculars Bb, Cc, Dd; make AL equal to AD, and join BL, CL, and draw the perpendiculars Ll, Cc; then, because the forces AB, AC, AD, are in equilibrio, ABLC must be a parallelogram, and AL is the force equivalent to AB and AC combined; then, because the lines Dd, Bb, Cc, Ll, are parallel, dA is equal to AL, and Ab to Co, or to cl; therefore AL is equal to the sum of Ab and Ac, which are the reductions of AB and AC;

Equili-
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Second
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therefore dA is equal to the same sum, and in equilibrium with them.

Fig. 13.



Secondly, Let them be reduced to one plane, EFGH, and let $\alpha\beta$, $\alpha\kappa$, $\alpha\delta$, be the reduced forces. The lines $D\delta$, $A\alpha$, $B\beta$, $C\kappa$, $L\lambda$, are all parallel, being perpendicular to the plane; therefore the planes AB , $\beta\alpha$, and CL , $\lambda\kappa$, are parallel, and $\alpha\beta$, $\kappa\lambda$, are parallel. For similar reasons, $\beta\lambda$, $\alpha\kappa$, are parallel; therefore $\alpha\beta\lambda\kappa$ is a parallelogram. Also, because the lines $D\delta$, $A\alpha$, $L\lambda$, are parallel, and DA is equal to AL ; therefore $\delta\alpha$ is equal to $\alpha\lambda$. But because $\alpha\beta\lambda\kappa$ is a parallelogram, the forces $\alpha\beta$, $\alpha\kappa$, are equivalent to $\alpha\lambda$; and $\alpha\delta$ is equal and opposite to $\alpha\lambda$, and will balance it; and therefore will balance $\alpha\beta$ and $\alpha\kappa$, which are the reductions of AB and AC to the plane EFGH, while $\alpha\delta$ is the reduction of AD ; therefore the proposition is demonstrated.

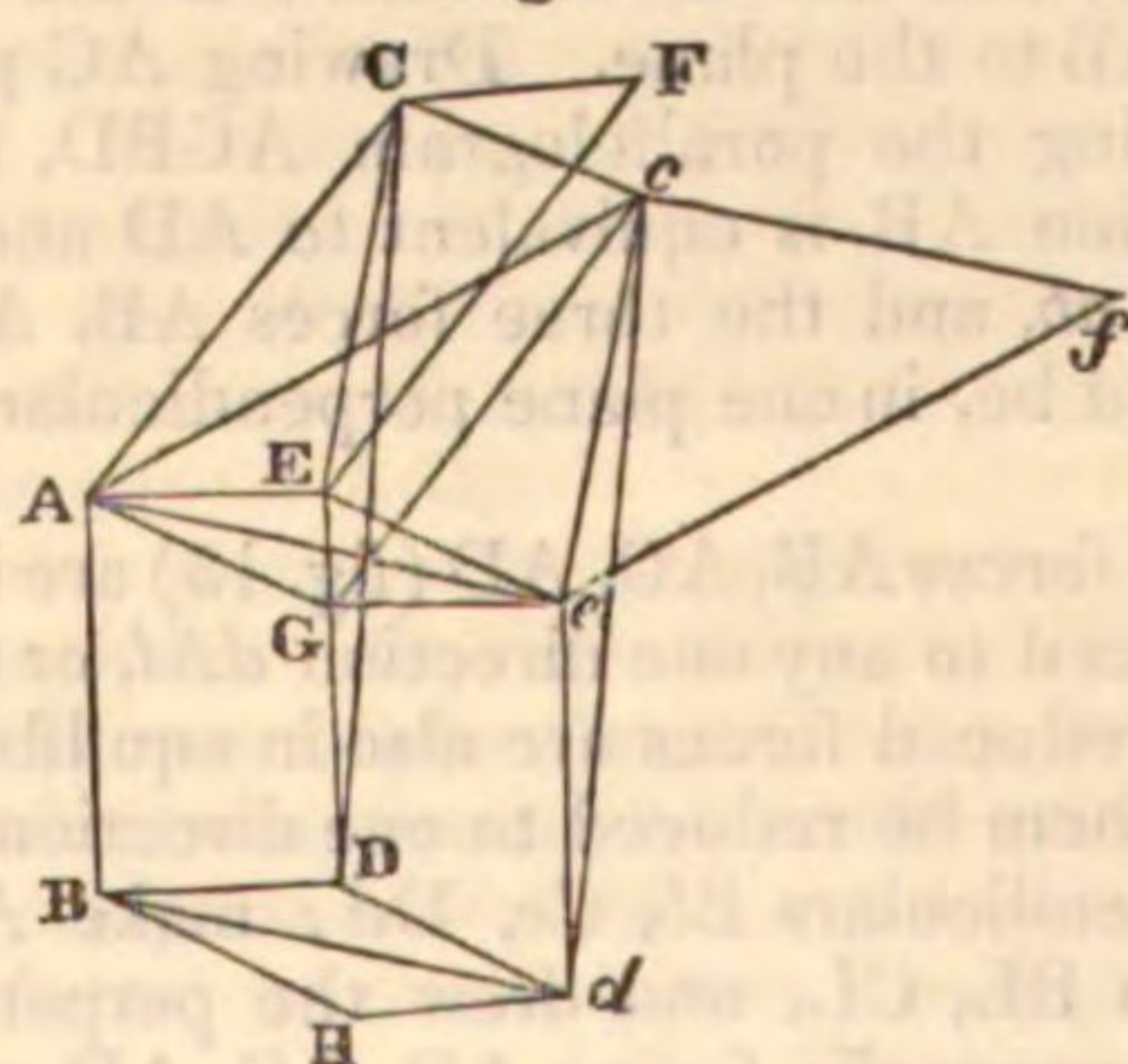
The most
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mode of re-
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The most usual and the most useful mode of reduction is to estimate all forces in the directions of three lines drawn from one point, at right angles to each other, like the three plane angles of a rectangular chest, forming the length, the breadth, and the depth of the chest. These are commonly called the three co-ordinates. The resulting force will be the diagonal of this parallelopiped. This process occurs in all disquisitions in which the mutual action of solids and fluids is considered, and when the oscillation or rotation of detached free bodies is the subject of discussion.

Relative
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67. The only other general theorem that remains to be deduced from this law of motion is, that if a number of bodies are moving in any manner whatever, and an equal force act on every particle of matter in the same or parallel directions, their relative motions will suffer no change;

Fig. 14.



for the motion of any body A (fig. 14), relative to another body B, which is also in motion, is compounded of the real motion of A, and the opposite to the real motion of B; for let A move uniformly from A to C, while B describes BD uniformly; draw AB, also draw AE equal and

parallel to BD; join EC, DC, ED. The motion of A, relative to B, consists in its change of position and distance. Had A described AE, while B described BD, there would have been no change of relative place or distance; but A is now at C, and DC is its new direction and distance. The relative or apparent motion of A therefore is EC. Complete the parallelogram ACFE; it is plain that the motion EC is compounded of EF, which is equal and parallel to AC, the real motion of A, and of EA, the equal and opposite to BD, the real motion of B.

Now let the motions of A and B sustain the same change; let the equal and parallel motions AG, BH, be compounded with the motions AC and BD; or let forces act at once on A and B, in the parallel directions AG, BH, and with equal intensities; in either supposition, the resulting motions will be Ae, Bd, the diagonals of the parallelograms AGeC and BHdD. Construct the figure as before, and we see that the relative motion is now ec, and that it is the same with EC both in respect of magnitude and position.

Here we still see the constant analogy between the composition of motions and the composition of forces. In the first case, the relative motions of things are not changed, whatever common motion be compounded with them all; or, as it is usually but inaccurately expressed, although the space in which they move be carried along with any motion whatever. In the second case, the relative motions and actions are not changed by any external force, however great, when equally exerted on every particle in parallel directions.

Thus it is that the evolutions of a fleet in a uniform current are the same, and produced by the same means, as in still water. Thus it is that we walk about on the surface of this globe in the same manner as if it neither revolved round the sun, nor turned round its axis. Thus it is that the same strength of a bow will communicate a certain velocity to an arrow, whether it is shot east, or west, or north, or south. Thus it is that the mutual actions of sublunary bodies are the same, in whatever directions they are exerted, and notwithstanding the very great changes in their velocities by reason of the earth's rotation and orbital revolution. The real velocity of a body on the earth's equator is about 3000 feet per second greater at midnight than at mid-day. For at midnight the motion of rotation nearly conspires with the orbital motion, and at mid-day it nearly opposes it. The difference between the velocities at the beginning of January and the beginning of July is vastly greater. And at other times of the day, and other seasons of the year, both motions of the earth are transversely compounded with the easterly or westerly motion of an arrow or cannon bullet; yet we can observe no change in the effects of the mutual actions of bodies.

68. This is an important observation, because it proves that forces are to be measured by no other scale than by the motions which they produce. We have had repeated occasions to mention the very different estimation of moving forces by Mr Leibnitz; and have shown how, by a very partial consideration of the action of those natural powers called pressures, he has attempted to prove that moving forces are proportional to the squares of the velocities; and we showed briefly in what manner a right consideration of what passes when motion is produced by measurable pressures, proves that the forces really exerted are as the velocities produced. But the most copious proof is had from the present observation, that, in fact, the mutual actions of bodies depend on their relative motions alone.

69. The Leibnitzian measure of moving force is altogether incompatible with the universal fact now mentioned,

Second
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Second
Law of
Motion.

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Second
Law of
Motion.

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viz. that the relative motions of bodies, resulting from their mutual actions, are not affected by any common motion, or the action of any equal and parallel force on both bodies; for this universal fact imports, that when two bodies are moving with equal velocities in the same direction, a force applied to one of them, so as to increase its velocity, gives it the same motion relative to the other, as if both bodies had been at rest. Here it is plain that the space described by the body in consequence of the primitive force, and of the force now added, is the sum of the spaces which each of them would generate in a body at rest. Therefore the forces are proportional to the velocities or changes of motion which they produce, and not to the squares of those velocities. This measure of forces, or the position that a force makes the same change on any velocity whatever, and the independence of the relative motions on any motion that is the same on all the bodies of a system, are counterparts of each other. Since this independence is a matter of observation in all terrestrial bodies, we are entitled to say that the powers which the Author of nature has imparted to natural bodies are no way different from what are competent to matter once called into existence. And it also follows from this, that we must always remain ignorant of the absolute motions of bodies. The fact that it has required the unremitted study of ages to discover even the relative motions of our solar system, is an argument to prove that the influence of this mechanical principle extends far beyond the limits of this sublunary world; nor has any phenomenon yet been exhibited which should lead us to imagine that it is not universal.

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without
force.

When we have made use of these arguments with some zealous partizans of Mr Leibnitz's doctrine, they have answered, that if indeed this independence of the relative motions of terrestrial bodies were observed to obtain exactly, it would be a conclusive argument. But the motion with which all is carried along is so great in comparison with the motions which we can produce in our experiments, that the small additions or diminutions that we can make to the velocity of this common motion must observe very nearly the proportions of the additions or diminutions of their squares. The differences of the squares of 2, 3, and 4, are very unequal; but the differences of the squares of 9, 10, 11, are much nearer to the ratio of equality; and the differences of the squares of 1000001, 1000002, 1000003, do not sensibly deviate from this ratio. But it is not fact that we cannot produce motions which have a very sensible proportion to the common motion. The motion of a cannon ball discharged with one third of its weight of powder, is nearly equal to that of the rotation of the earth's equator. When, therefore, we discharge the ball eastward, we double its motion; when to the westward, we destroy it. Therefore, according to Leibnitz, the action in the first case is three times the action in the second. In the first case it changes the square of the velocity (which we may call 1) from 1 to 4; and, in the second, it changes it from 1 to 0. But, say the Leibnitzians, the velocity of rotation is but $\frac{1}{85}$ of the orbital velocity of the earth, and our observations of the velocities of cannon bullets are not sufficiently exact to ensure us against an error of $\frac{1}{31\frac{1}{2}}$. But the latter observations on the peculiar motions of the fixed stars concur in showing, that the sun, with his attending planets, are carried along with a very great motion, which, in all probability, has a sensible ratio to the orbital motion of the earth. This must make a prodigious change on the earth's absolute motion, according as her orbital motion conspires with, opposes, or crosses, this other motion; the earth may even be at absolute rest in some points of its orbit. Thus will the composition with

the motions produced in our experiments be so varied that cases *must* occur when the difference of the results of the two measures of force will be very sensible.

But, further, they have not attended to the agreement of our experiments when the discharges of cannon are made in a direction transverse to that of the common motion. Here the immensity of the common motion, and the minuteness of our experimental velocities, can have no effect in diminishing the difference of the results of the two doctrines. This will appear distinctly to every reader who is much conversant in disquisitions of this kind; and it is in these more moderate motions that the complete independence of the relative motions on the common motions most accurately appears. Pendulum clocks and watches have been often executed which do not deviate from perfect equability of motion one part in 86,400. This could not be obtained in all directions of the oscillations, if the forces deviated from the ratio of the velocities one part in 86,400.

On the whole, we may consider it as established on the surest foundation, that the action of those powers of natural bodies which we call *pressures*, such as the force of springs, the exertions of animals, the cohesion of bodies, as well as the action of those other incitements to motion which we call *attractions* and *repulsions*, such as gravitation, magnetism, and electricity, is proportional to the change of velocity produced by it. And we must observe here, that this is not a mere mode of conception, the result of the laws of human thought, which cannot conceive a natural power as the cause of motion otherwise than by its producing motion, and which cannot conceive any degree of *moving* power different from the degree of the motion. This is the abstract doctrine, and is true whether the pressures are proportional to the velocities or to the squares of the velocities.

But we see further, that whatever is the pressure of a spring (for example) on a quiescent body, yet the pressure actually exerted in producing a double velocity is only double, and not quadruple, as our first imperfect observations make us imagine.

70. Sir Isaac Newton has added another proposition to the number of laws of motion; namely, that *every action is accompanied by an equal and contrary re-action*. But in affirming this to be a law of nature, he only means that it is a universal fact: and he makes this affirmation on the authority of what he conceives to be a law of human thought; namely, that those qualities which we find in all bodies on which we can make experiments and observations, are to be considered as universal qualities of body. But we have limited the term *law of motion* to those consequences that necessarily flow from our notions of motion, of the causes of its production and changes. Now this third Newtonian proposition is not such a result. A magnet is said to act on a piece of iron, when, and only when, the vicinity of the magnet is observed to be accompanied by certain motions of the iron. But it by no means follows from this observation, that the presence of the iron shall be accompanied by any motion, or any change of state whatever of the magnet, or any appearance that can suggest the notion that the iron acts on the magnet. When this was observed, it was accounted a discovery. Newton *discovered* that the sun acts on the planets, and that the earth acts on the moon; and Kepler *discovered* that the moon re-acts on the earth. Newton had observed that the iron re-acts on the magnet; that the actions of electrified bodies were mutual; and that every action of sublunary bodies was, in fact, accompanied by an equal and contrary re-action. On the authority of his rule of philosophizing, he affirmed that the planets re-act on the sun, and that the sun is not at rest, but is continually agi-

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tated by a small motion round the general centre of gravitation. He pointed out several consequences of this re-action. Astronomers examined the celestial motions more narrowly, and found that those consequences do really obtain, and disturb all the planetary motions. It is now found that this reciprocity of action obtains throughout the solar system with the utmost precision, and that the third Newtonian proposition is really a law of nature, although it is not a law of human thought. It is a discovery. The contrary involves no absurdity or contradiction. It would indeed be contrary to experience; but things might have been otherwise. It is conceivable and possible that a ball A shall strike another equal ball B, and carry it along with it, without any diminution of its velocity. The fact that the velocity of A is reduced to one half, is the indication of a force residing in B, which force changes the motion of A; and the intensity of this force is learned from the change which it produces. This is found to be equal to the change produced by A on B. And thus the re-action of B is *discovered* to be equal to the action of A.

It is highly probable that this universality and equality of re-action to action is the consequence of some general principle, which we may in time discover; meanwhile we are entitled to suppose it universal, and to reason from this topic in our disquisitions about the actions of bodies on each other.

Maupertuis, Leibnitz, and other philosophers, have entertained very inadequate opinions concerning the foundation of the laws of motion.

Although the celebrated philosophers of Europe have at last agreed in the reception of the two propositions so largely discussed by us as the laws of motion, they have differed exceedingly in their opinion about their origin and validity. Some asserted that they are entirely matters of experience, while others affirmed them to be necessary truths. The Royal Academy of Berlin made this question the subject of their prize dissertation in the year 1744. Mr Maupertuis, president of the academy, published a dissertation, in which he endeavoured to prove that they are necessary truths, only because *they are such as make the quantity of action the least possible*, an economy which is worthy of infinite wisdom, and therefore certainly directs the choice of the Author of nature. On this account alone are they necessary truths.

But this is not the way to consider a question of this kind. We know too little about infinite wisdom to be able to say, with Messrs Leibnitz and Maupertuis, that the Deity should or should not impress on bodies laws different from those which are essential to matter; and we are not to inquire whether God could or could not do this. We know from our own experience, that matter, when subjected to the action of intelligence, may be moved in a way extremely different from what it would follow if left to itself, and that its motions may either be regulated by fixed but contingent law, or may be without any constancy whatever, and vary in every instance. When we suppose the existence of matter and motion, a variety of truths are involved in the supposition, in the same manner as all the theorems in the third book of Euclid's *Elements* are involved in the conception of a circle and a straight line. Our first employment should be to evolve those truths. We can do this in no way but by first noticing the relations of the ideas that we have of the different objects of contemplation, and then following the laws of human thought in our judgments concerning those relations. This process of the mind is expressed in the train of a geometrical demonstration. The different parts or argumentations of this train are not the causes of our conclusions, but the means by which we form our judgment; not the reasons of the truth of our ultimate conclusion, but the steps by which we arrive at the knowledge of it. The young geometer generally thinks otherwise. But that this is the

matter of fact, is plain from this, that more than one demonstration, and often very different, can be given of the same theorem. We must proceed in the same manner in the present question; and the first general truths which we find involved in the notions of matter, motion, and force, must be received as *necessary* truths. The steps by which we arrive at the discovery are the laws of human thought; and the expression of the discovery, involving both the truth itself, and the manner of conceiving it, is a necessary law of motion. There may be other facts, perhaps as general as any of those necessary laws, but which do not necessarily result from the relations of our notions of motion and of force. These are discovered by observation only, and they serve to characterize the forces which nature presents to our view. These facts are *contingent* laws of motion.

We apprehend that this method has been followed in treating this article. The first proposition, termed a *law of motion*, is only a more convenient way of expressing our contemplation of a motion in body as an effect of the general cause which we term *force*. The second proposition does nothing but express more distinctly the relation between this cause and its effect; it expresses what we mean by the magnitude and the kind of the cause. The proposition, stating the composition of forces, is but another form of the same law, better suited to the ordinary procedure in geometrical disquisitions.

These propositions might have completed the doctrines of dynamics; but it appears that, in order to the production of a material universe which should accomplish the purposes of the Creator, it was necessary that there be certain characteristic differences between the forces inherent in the various collections of matter which compose this universe. The facts or physical laws (for the above-mentioned laws are metaphysical) of motion may be different from those which would have been observed had matter been left entirely to itself. This difference may have introduced other laws of motion as necessarily resulting from the nature of the forces. We have occasionally mentioned some instances where this appears to obtain, but gave good reasons for affirming that a due examination of all circumstances which may be observed in the production or variation of motion by those forces, has demonstrated, that there are no such deviations from the two laws of motion already determined, but that all the mechanical powers of bodies, when considered merely as causes of motion, act agreeably to the same laws. Careful examination was, however, said to be necessary.

This examination must consist in distinctly noticing the circumstances that occur in the production of motion by any force whatever. It is by no means enough to state simply the intensity of the force and the direction of its exertion. If a force continue to act, it continues to vary the motion already produced. Should the force change its intensity or direction while it is acting, these circumstances must induce still farther changes in the motion; and it is not till all action has ceased that the motion is brought to its ostensible state, in which it is the object of our attention and our future discussions. Instances of the effects of such continued and such varied actions are to be seen in most of the phenomena of nature or art. The communication of motion by impulse is perhaps the only instance (very frequent indeed) that can be produced where this is not necessary; nay, we shall perhaps find reason to conclude that this instance is not an exception, and that even the communication of motion from one billiard ball to another is brought about by an action continued for some time, and greatly varied during that time. Much preparation is therefore necessary before we can apply the

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general laws of motion to the solution of most of the questions which come before us in the course even of our elementary disquisitions. We must lay down some general propositions which determine the results of the continued, and perhaps varied, actions of moving forces; and we must mark the different effects of the simple continuation of action, and also those of the variations in this continued action, both in respect of intensity and direction. The effect of a mere continuance of action must be an acceleration of the motion, or a retardation of it if the force continue to act in the opposite direction. The effect of the continued action of a transverse force must be a continual deflection, that is, a curvilinear motion. These must therefore now occupy our attention in their order.

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Circumstantial exposition of our conception of the condition of a body in respect to motion.

71. All men can perceive that a stone dropped from the hand, or sliding down an uniform slope, has its motion continually accelerated, and that the motion of an arrow rising perpendicularly through the air is continually retarded; and they feel no difficulty in conceiving these changes of motion as the effects of the continual operation of their weight or heaviness. The falling stone is in a different condition in respect of motion in the beginning and end of its fall. In what respect do these states of the body differ? Only in respect to what we call its *velocity*. This is an affection of motion; it is an expression of the relation between the two notions or ideas which concur to form the idea of motion, namely, the space and the time. These are all the circumstances that we observe in a motion. Time elapses, and during its currency a space is described. The term *velocity* expresses the magnitude of the space, which corresponds to some unit of time. Thus the rate of a ship's motion is determined when we say that it is nine miles in an hour, or nine miles per hour. We sometimes say (but awkwardly) "the motion is at the rate or with the velocity of a mile in three days." It is most conveniently expressed by a number of some given units of length, which completely make up the line described during this unit of time. But the mechanicians express it in a way more general by a fraction, of which the numerator is a number of inches, feet, yards, fathoms, or miles, and the denominator is the number of seconds, minutes, or hours employed in moving along this line. This is a very proper expression; for when we speak of any velocity, and continue to reason from it, we conceive ourselves to speak of something that remains the same, in the different occasions of using the term. Now if the velocity be constant, it is indifferent how long the line may be, because the time of its description will be lengthened in the same proportion. Thus if 48 feet be described in 12 seconds, 36 feet will be described in 9 seconds, 16 feet will be described in 4 seconds, &c. Now $\frac{48}{12}$, $\frac{36}{9}$, and $\frac{16}{4}$, are fractions of equal value, being equal to $\frac{4}{1}$, or 4, that is, to the velocity of 4 feet per second. The value of this fraction, or the quotient of the number of the units of length, divided by the number of units of time, is the number of those units of length described uniformly in one unit of time.

Magnitude of a velocity of which we have no actual measure.

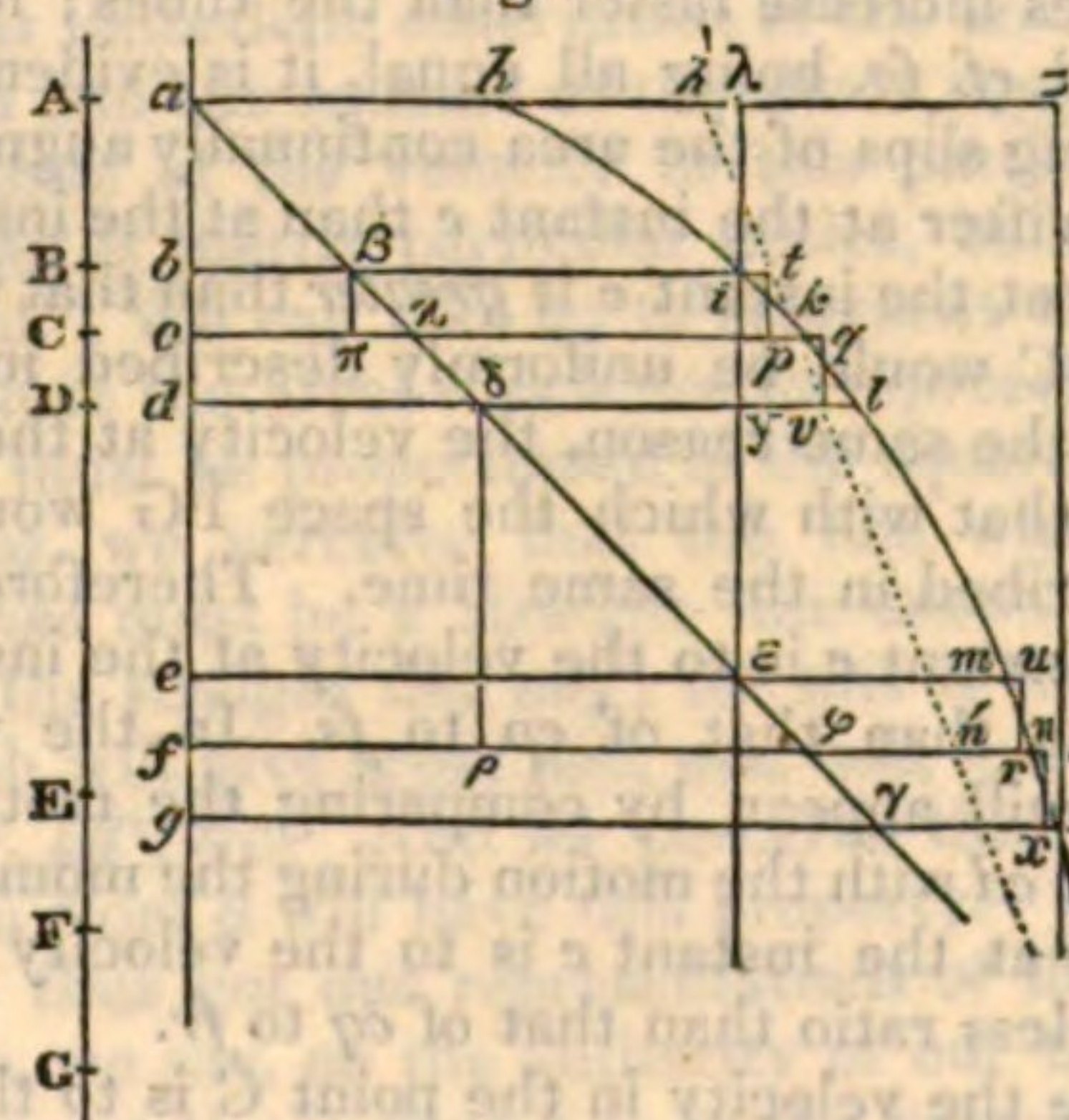
But how shall we determine the velocity in any instant or in any point of a motion that is continually changing? Suppose that a body has fallen 144 feet, and that we would ascertain its velocity in that point of its fall, or the velocity which it has in passing through that point. In the next second the body falls 112 feet farther. This cannot be the measure of the velocity at the beginning of the fourth or the end of the third second. It is too great. The fall during the preceding second was 80 feet. This is too

small. The mean of these two, or $\frac{80 + 112}{2} = \frac{192}{2} = 96$, is probably more exact. Due attention to the nature of this motion shows us that 96 is the proper measure, or that the motion at that instant is at the rate of 96 feet per second. But it is peculiar to this kind of motion that the half sum of the spaces described in two succeeding equal moments is the measure of the velocity in the middle instant. Therefore this method will not generally give an accurate measure. Yet it is indispensably necessary to obtain some accurate measure; for it is in this particular alone that the state of the body differs from its similar state in another instant. The difference of place makes no distinction; for if a body continue its motion unchanged, its condition in every different instant of time, or point of space, is unchanged, or the same. The change of place is not a change of motion, but is involved in the very conception of the continuation of the motion. The change of condition consists, therefore, in the change of velocity: therefore the change of velocity is the only indication and the only measure of the action (perhaps accumulated) of the changing force. It is therefore the chief object of our search; and accurate measures of velocity are absolutely necessary.

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72. When the velocity changes continually, there can be no *actual* measure of it. In what then does the magnitude of a velocity consist, when there is no actual measure of it? It is a certain undescribable *determination*, by which, if not changed, a certain space *would* be uniformly described in a given unit of time. Thus we know, that if, when a stone has fallen sixteen feet, its motion be directed along a horizontal plane, without diminution, it will move on for ever at the rate of thirty-two feet per second. The space which would be thus described is not the velocity, but the measure of the velocity. But the proportions of those spaces, being the proportions of those measures, are the proportions of the velocities themselves. We may discover these proportions in the following manner:

Fig. 15.



Let ACG (fig. 15) be a line described by a body with a motion any how continually but gradually varied; and let it be required to determine the proportion of the velocity in any point C to the velocity in any other point F.

AXIOM.—If A be to B in a ratio that is greater than any ratio less than that of C to D, but less than any ratio greater than that of C to D, then A is to B as C to D.

Take the straight line *acg* to represent the time of the body's motion along ACG, so that the points *a, c, f, g*, may represent the instants of time in which the body passes through the points A, C, F, G; and the portions *ac, cf, fg*, of the line *ag*, may represent the times employed in describing the portions AC, CF, FG; and therefore *ac* is to *af* as the time of describing AC to the time of describing AF.

Momentary proportion of velocities that are continually changing.

Fundamental requisite in all mechanical disquisitions.

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Moreover, let $hkno$ be a line so related to the straight line $acfg$, by the perpendicular ordinates ah , ck , fn , go , that the areas $ackh$, $afnh$, $agoh$, may be proportional to the portions AC , AF , AG , of the line described by the moving body; and let this relation be true with respect to every point B , D , E , &c. and the corresponding points b , d , e , &c.

Then it is affirmed that *the velocity in the point C is to the velocity in the point F as ck is to fn .*

Let the equal lines bc , cd , ef , fg , represent equal moments of time, and let B , D , E , G , be the points through which the body is passing at the instants b , d , e , g . Then the areas $bikc$, $chld$, $emnf$, $fnog$, will represent, and be proportional to, the spaces BC , CD , EF , FG , which are described during the moments bc , cd , ef , fg .

Draw tp parallel to ag , so as to make the rectangle $btpc$ equal to the trapezium $bikc$; and draw the lines qv , ur , sx , in the same manner, so that each rectangle may be equal to its corresponding trapezium.

If the motions had been uniform during the moments bc and fg , that is, if the spaces BC and FG had been uniformly described, then the velocity in the point C would have been to the velocity in the point F as cp to fs ; for since the rectangles $btpc$ and $fsxg$ are respectively equal to the trapeziums $bikc$ and $fnog$, and since $bikc$ is to $fnog$ as BC is to FG , the rectangle $btpc$ is to the rectangle $fsxg$ as BC to FG . But because these two rectangles have equal altitudes bc and fg , they are to each other in the proportion of their bases cp and gx , or cp and fs . Therefore BC is to FG as cp to fs . But if BC and FG are uniformly described in equal times, they are proportional to the velocities of those uniform motions. Therefore cp is to fs as the velocity with which BC is uniformly described to the velocity with which FG is uniformly described in an equal time.

But the motion expressed by the figure is not uniform, because the line hlo recedes from the axis ag , and the areas, cut off by the parallel ordinates, increase in a greater proportion than the corresponding parts of the axis; that is, the spaces increase faster than the times; for the moments bc , cd , ef , fg , being all equal, it is evident that the corresponding slips of the area continually augment. The motion is swifter at the instant c than at the instant b , and the velocity at the instant c is *greater* than that with which the space BC would be uniformly described in the same time. For the same reason, the velocity at the instant f is *less* than that with which the space FG would be uniformly described in the same time. Therefore the velocity at the instant c is to the velocity at the instant f in a greater ratio than that of cp to fs . In the very same manner, it will appear, by comparing the motion during the moment cd with the motion during the moment ef , that the velocity at the instant c is to the velocity at the instant f in a less ratio than that of eq to fr .

Therefore the velocity in the point C is to the velocity in the point F in a greater ratio than that of cp to fs , but in a less ratio than that of eq to fr .

But by continually diminishing the equal moments bc , cd , ef , fg , it is evident that cp and eq continually approach to equality with ck , and fr and fs continually approach to equality with fn ; that when cp is less than ck , fs is greater than fn , and when eq is greater than ck , fr is less than fn .

Therefore the velocity in the point C is to the velocity in the point F in a ratio that is greater than the ratio of *any* line less than ck to *any* line greater than fn , but which is less than the ratio of *any* line greater than ck to *any* line less than fn . Therefore the ratio of the velocity in C to the velocity in F is greater than any ratio that is less than that of ck to fn ; but it is less than any ratio that is greater than that of ck to fn . Therefore the velo-

city in the point C is to the velocity in the point F as ck to fn .

This important theorem may be expressed in more general terms as follows:

If the abscissa ag of a line hko represent the time of any motion, and if the areas bounded by parallel ordinates be proportional to the spaces described, the ordinates are proportional to the velocities.

REMARK.—The propriety or aptitude of expressing the time by the portions of the axis acg will perhaps appear more clearly in the following manner:

Let acg be any straight line, and let hkv be another line straight or curved. Let the straight line ahz , perpendicular to ag , be carried uniformly down along this line, keeping always perpendicular to it, and therefore always parallel to its first position ahz . In its various situations ckz , emz , &c. it will cut off areas $ackh$, $aemh$, &c. bounded by the axis, by the ordinates ah and ck , or by the ordinates ah and em , &c. and by the line hkg . By this motion the moveable ordinate is said, in the language of modern geometry, to *generate* the areas $ackh$, $aemh$, &c. At the same time, let a point A move along the line ACG , setting out from A at the instant when the line az sets out from a ; and let the motion of the point A be so regulated that the spaces AB , AC , AD , &c. generated by this motion may increase at the same rate with the areas $abih$, $ackh$, $adlh$, &c. or such that we shall have AB to AC as $abih$ to $ackh$, &c. It is plain that the motion along AG is the same with that described in the enunciation of the proposition; for because the motion of the ordinate az along the axis ag is supposed to be uniform, the spaces ab , ac , ad , &c. are proportional to the times in which they are described, and may therefore be taken to measure or to represent those times.

73. Cor. 1. *In a motion continually varied, the velocities in the different points of the path are to each other in the limiting or ultimate ratio of the spaces described in equal times, those times being supposed to diminish continually; for it is evident that if the equal moments bc , cd , ef , fg , are supposed to diminish continually till the instants b and d coalesce with c , and the instants e and g coalesce with f , then the ratio of ck to fn is the limit of the continually increasing ratio of cp to fs , or of the continually diminishing ratio of eq to fr . Sir Isaac Newton calls this the ultimate ratio of cp to fs , or of eq to fr . Now the ratio of cp to fs is, by construction, the same with the ratio of the rectangle $btpc$ to the rectangle $fsxg$, and the ratio of eq to fr is the same with the ratio of the rectangle $eqvd$ to the rectangle $eurf$. But the ratio of the rectangle $btpc$ to the rectangle $fsxg$ is the same with the ratio of the space $bikc$ to the space $fnog$; that is (by hypothesis) the same with the ratio of the space BC to the space FG ; and the ratio of the rectangles $eqvd$ and $eurf$ is the same with that of the spaces CD and EF . Therefore the ratio of the velocity at C to the velocity at F is the same with the ultimate ratio of the small increments BC , FG , or CD , EF of the spaces generated in very small and equal times.*

It is also evident, that because the ratio of ck to fn is the limit both of the ratio of cp to fs and of the ratio of eq to fr , these ultimate ratios are the same, and that we may say that the velocity in C is to the velocity in F in the ultimate ratio of BC to EF , or in the ultimate ratio of CD to FG .

We also can easily perceive that the ratio of the area $bikc$ to the area $emnf$ approaches more near to the ratio of ck to fn as we take the moments bc and ef smaller. Therefore, in many cases of practice, where it may be easy to measure the spaces described in the different small moments of the motion, but difficult to ascertain their ultimate ratio, so as to obtain accurate measures of

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It often happens that we have it not in our power to compare the spaces described in small moments which are precisely equal. Still we can find the exact proportion of the velocities, if we can ascertain the ultimate ratio of the increments of the spaces, and the ultimate ratio of the moments of time in which these increments are described; for it is plain, by considering the gradual approach of the points p and r to the points h and n , that the ratio of ck to fn is still the ultimate ratio of the bases of rectangles equal to the mixtilineal areas, whether the altitudes (representing the moments) are equal or not. Now the bases of two rectangles are in the proportion of the rectangles directly, and of their altitudes inversely. But the ultimate ratio of the altitudes is the ultimate ratio of the moments, and the ultimate ratio of the rectangles is the ultimate ratio of the spaces described in those unequal moments. Therefore, in such cases, we have,

74. Cor. 2. *The velocities are in the ratio compounded of the direct ultimate ratio of the momentary increments of the spaces, and the inverse ultimate ratio of the increments (or moments) of the times in which these increments of the spaces are made.*

If s , v , and t , are taken to represent the magnitudes of the spaces, velocities, and times, and if ds , dt , and dv , are taken always in the limiting or ultimate ratio of their momentary increments,¹ we shall have v always in the proportion of ds directly, and of dt inversely. We express

this by the proportional equation $v \div \frac{ds}{dt}$, which is equivalent to the analogy $V : v = \frac{dS}{dT} : \frac{ds}{dt}$, or $V : v = dSdt : dsdT$.

75. N. B. Here observe that this is not the only way of stating the relation of space and time—the abscissa may be made the time, and the ordinate the space: then

the velocity $= \frac{dy}{dx}$.

The converse of this proposition may be thus expressed.

Converse theorem.

76. *If the axis ag of the line hko represent the time of a varied motion along the line AG , and if the ordinates ah , bi , ck , &c. be as the velocities in the instants a , b , c , or in the points A , B , C ; then the areas $abih$, $ackh$, $adlh$, &c. are proportional to the spaces AB , AC , AD , &c.*

This may be demonstrated in the same way with the former; but the indirect demonstration is more brief, and equally strict.

If the spaces AC , AF , &c. are not proportional to the areas $ackh$, $afnh$, &c. they are proportional to some other areas $ackh'$, $afnh'$, &c. which are bounded by the same ordinates, and by another line $h'kn'$. But because the areas $ackh'$, $afnh'$, &c. are always proportional to the spaces AC , AF , &c. described on the line AG , the velocity in the point C is to the velocity in the point F as the ordinate ck is to the ordinate fn' ; but, by hypothesis, the velocity in C is to the velocity in F as ck to fn , and fn' is equal to fn , which is absurd. Therefore the spaces AC , AF , are not proportional to any other areas, &c.

77. Cor. *The ultimate ratio of the momentary increments of the spaces is compounded of the ratio of the velocities, and the ultimate ratio of the increments of the times: for when the moments bc , ef , are equal, it is evident that the ultimate ratio of the rectangles $bcpt$, $efru$ is the same with the ultimate ratio of the increments of the spaces. But the ultimate ratio of these rectangles is the same with that of their bases cp and fr ; that is, the ratio of ck to fn , that is, the ratio of the velocities. And when the moments are unequal, the ratio of the rectangles is compounded of the ratio of their bases and the ratio of their altitudes; that is, compounded of the ratio of the velocities and the ultimate ratios of the moments of time.*

We have therefore $dS : ds = VdT : vdt$ and $ds \div vdt$.

It most commonly happens that we can only observe the accumulated results of varied motions, and in them we only observe a space passed over, and a certain portion of time that has elapsed during the motion; but being able to distinguish the portions of the whole space which are described in known portions of the whole time, and having made such observations in several parts of the motion, we discover the general law that the motion affects, and we affirm this law to hold universally, even though we have not observed it in every point. We do this with a degree of probability and confidence proportioned to the frequency of our observation. It is not till we have done this that we can make use of the first of these two propositions, which enables us to ascertain the velocity of the motion in its different moments. Thus, if we observe that a stone in falling descends one foot in the quarter of a second, 16 feet in a second, 64 feet in two seconds, and 144 feet in three seconds, the general law immediately observed is, "that the spaces described are as the squares of the times;" for 1 is to 16 as the square of $\frac{1}{4}$ to the square of 1. Again, 16 is to 64 as 1^2 to 2^2 , and 16 is to 144 as 1^2 to 3^2 . Hence we infer, with great probability, that the stone would fall 36 feet in a second and a half; for 16 is to 36 as 1^2 to $1\frac{1}{2}^2$; and we conclude in the same way for all other parts of the motion.

78. This immediate observation of the analogy between the spaces and the squares of the times suggests an easy determination of the velocity in this particular kind of motion, and it merits particular notice, being very often referred to. We can take ag to represent the time, and then, because the areas which are to represent the spaces described must be proportioned to the squares of the portions of ag , we perceive that the line which comes in place of hko must be a straight line drawn from a ; for example, the straight line $ad\gamma$; for this is the only boundary which will give areas $ab\beta$, $ac\kappa$, $ad\delta$, &c. proportional to ab^2 , ac^2 , ad^2 , &c. And we perceive that any straight line drawn from a will have this property.

Having thus got our representations of the times and the spaces, we say, on the authority of our theorem, that the velocity at the instant b is to the velocity at the instant d as $b\beta$ to $d\delta$, &c. And now we begin to make inferences purely geometrical, and express our discovery of the velocities in a very general and simple manner. We remark, that $b\beta$ is to $d\delta$ as ab is to ad ; and we make the same affirmation concerning the magnitudes represented by these lines. We say that the velocity at the instant b is to the velocity at the instant d as the time ab is to the time ad . We say, in terms still more general, that the velocities are proportional to the times from the beginning of the motion. We moreover perceive, that the spaces are

¹ In this article, as originally printed, the symbols s , t , and v were employed to represent the things here denoted by ds , dt , and dv : a like change in the notation of the fluxions of the quantities will be made throughout the article.

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We can further infer, from the properties of the triangle, that the momentary increments of the spaces are proportional to the momentary increments of the squares of the times, or of the squares of the velocities.

We also observe, that not only the whole acquired velocities are proportional to the whole elapsed times, but that the increments of the velocities are proportional to the times in which they are acquired; for $\pi\pi$ is to ep as bc to df , &c. Equal increments of velocity are therefore acquired in equal times. Therefore such a motion may, in great propriety of language, be denominated a *uniformly accelerated motion*; that is, a motion in which we observe the spaces proportioned to the squares of the times, is a motion uniformly accelerated; and spaces in the duplicate ratio of the times form the ostensible characteristic of an uniformly accelerated motion.

79. Lastly, if we draw $s\lambda$ parallel to the axis ab , we perceive that the rectangle $aes\lambda$ is double of the triangle aes . Now, because ae represents the time of the motion, and es represents the acquired velocity, the rectangle $aes\lambda$ will represent the space which would be uniformly described with the velocity es during the time ae . But the triangle aes represents the space really described with the uniformly accelerated motion during the same time. Hence we infer, that the space that is described in any time, with a motion increasing uniformly from nothing, is one half of the space which would be uniformly described during the same time with the final velocity.

These are but a part of the inferences which we may draw from the geometrical properties of those representations which we had selected of the different measureable affections of motion. We may affirm, with respect to the motions themselves, all the inferences which relate to magnitude and proportion, and thus improve our knowledge of the motions.

We took the opportunity of this very simple and perspicuous example, to give our readers a just conception of the *mathematical method* of prosecuting mechanical knowledge, and to make them sensible of the unquestionable authority for every theorem deduced in this manner.

One of the most important is, to discover the accumulated result of a motion of which we only observe the momentary increments. This is to be done by finding the area, or portions of the area, of the mixtilineal space $agoh$; and it is evidently analogous to the inverse method of fluxions, or the integral calculus.

In most cases, we must avail ourselves of the corollary $ds = vdt$, and we obtain the solution of our question only in the cases where our knowledge of the quantities ds , dt , and v (considered as geometrical magnitudes, that is, as lines and surfaces), enables us to discover s and t .

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80. Having thus discovered the proportions of the velocities in motions varying in any manner whatever, we can observe the variations which happen in them. These variations are the effects, and the only marks and measures, of the changing forces. They are the characteristics of their kinds (considered merely as moving forces); that is, the indications of the directions in which they act; for this is the only difference in kind of which they are susceptible in this general point of view. If they increase the velocity, their direction must be conceived as the same with that of the previous motion; because the result of the action of a force is equivalent to the composition of the motion which that force would produce in a

quiescent body with the motion already existing; and an increase of velocity is equivalent to the composition of a motion in the same direction.

Having no other mark of the force but the acceleration, we have no other name for it in the abstract doctrines of dynamics, and we call it an *accelerating force*. Had it retarded the motion, we should have called it a *retarding force*.

In like manner we have no measure of the *magnitude or intensity* of an accelerating force, but the acceleration which it produces. In order therefore to investigate the powers which produce all the changes of motion, we must endeavour to obtain measures of the acceleration.

A continual increase of velocity is the effect of the continued action of accelerating forces. If equal increments of velocity are produced in every succeeding equal moment of time, we cannot conceive that there is any change in the accelerating force. Therefore a uniformly accelerated motion is the mark of the unvaried action of an accelerating force, that is, of the continued action of a constant force; of a force whose intensity is always the same. When therefore we observe a body describe spaces proportional to the squares of the times, we must infer that it is urged forward by a force whose intensity does not change; and, on the other hand, a constant force must produce a uniformly accelerated motion by its continued action. And if any previous circumstances assure us of this continued action of an invaried force, we may make all the inferences which were mentioned under the article of uniformly accelerated motion.

81. That force must surely be accounted double which produces a double increment of velocity in the same time by its uniform action; we can form no other estimation of its magnitude. And in general, *accelerating forces must be accounted proportional to the increments of velocity which they produce, by acting uniformly during the same or equal times*.

Supposing them to act on a body at rest. Then the velocity produced is itself the increment; and we must say that accelerating forces are proportional to the velocities which they generate in a body in equal times. And because we found (No. 79), that the space described with a uniformly accelerated motion is half the space which would be uniformly described in the same time with the final velocity, which space is the direct measure of this velocity, and because halves have the same proportion with the wholes—we may say that *accelerating forces are proportional to the spaces through which they impel a body from rest in equal times by their uniform action*.

This is an important remark; because it gives us an easy measure of the force, without the trouble of first computing the velocities. It also gives us the only distinct notion that we have of the measurement of forces by the motions which they produce. When speaking of the composition of forces, we distinguished or denominated them by the sides and diagonal of a parallelogram. These lines must be conceived as proportional to the spaces through which the forces urge the body uniformly during the small and insensible time of their action, which time is supposed to be the same for both forces; for the sides of the parallelogram are supposed to be separately described in equal times, and therefore to be proportional to the velocities generated by the constituent forces. If indeed the forces do not act uniformly, nor similarly, nor during equal times, we cannot say (without farther investigation) what is the proportion of the intensity of the forces, nor can we infer the composition of their action. We must at least suppose, that in every instant of this very small time of their joint action, their direction remains unchanged, and that their intensities are in the

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same ratio. We shall see by and by, that with these conditions the sides of the parallelogram are still proportional to the velocities generated. In the mean time we may take the spaces through which a body is uniformly impelled from rest (that is, with a uniformly accelerated motion) as the measures of the forces; yet these spaces are but the halves of the measures of the velocities. Then, if a body be moving with the velocity of thirty-two feet per second, and an accelerating force acts on it during a second, and if this force be such that it would impel the body (from a state of rest) sixteen feet, it will add to the body a velocity of thirty-two feet per second. Accordingly, this is the effect of gravity—the weight of a pound of lead may be considered as a force which does not vary in its intensity. We know that it will cause the lead to fall sixteen feet in a second; but if the body has already fallen sixteen feet, we know that it is then moving with the velocity of thirty-two feet per second. And the fact is, that it will fall forty-eight feet farther in the next second, and will have acquired the velocity of sixty-four feet per second. It has therefore received an augmentation of thirty-two feet of velocity by the action of gravity during the second second; and gravity is in fact a constant force, causing equal increments of velocity in equal times, however great the velocities may be. It does not act like a stream of fluid, whose impulse or action diminishes as the solid body withdraws from it by yielding.

But supposing that we have not compared the increments of velocity uniformly acquired during equal times, in what manner shall we measure the accelerating forces? In such a case that force must be accounted double which generates the same velocity, by acting uniformly during half the time; for when the force is supposed invariable, the changes of velocity which it produces are proportional to the times of its action; therefore if it produces an equal velocity in half the time, it will produce a double velocity in an equal time, and is therefore a double force. The same may be said of every proportion of time in which an equal change of velocity is produced by the uniform action of an accelerating force. The force must be accounted greater in the same proportion that the time required for the production of a given velocity in a body is less. Hence we infer that *accelerating forces are inversely proportional to the times in which a given change of velocity is produced by their uniform action.*

82. By combining these two propositions, we establish this general theorem:

Measure of Accelerating forces are proportional to the changes of velocity which they produce in a body by their uniform action directly, and to the times in which these changes are produced inversely.

If, therefore, A and a are the forces, V' and v' the changes of velocity, and T' and t' the portions of time in which they are uniformly produced, we have

$$A : a = V' T' : v' t', = \frac{V'}{T'} : \frac{v'}{t'}$$

$$\text{and } a \doteq \frac{v'}{t'}.$$

The formula $a \doteq \frac{v'}{t'}$ is not restricted to any particular magnitude of v' and t' . It is true, therefore, when the portion of time is diminished without end; for since the action is supposed uniform, the increment of velocity is lessened in the same proportion, and the value of the fraction $\frac{v'}{t'}$ remains the same. The characters or symbols v' and t' are commonly used to express *finite* portions of v and t . The symbols $\dot{v}$ and $\dot{t}$ are used by Newton to ex-

press the same things taken in the ultimate or limiting ratio. (These have been changed to dv and dt throughout this article.) They are usually considered as *infinitely small* portions of v and t . We shall abide by the

$$\text{formula } a \doteq \frac{dv}{dt}.$$

83. It must always be kept in mind, that v and t are abstract numbers; and that v refers to some unit of space, such as a foot, an inch, a yard; and that t refers to some unit of time, such as an hour, a minute, a second; and especially that a is the number of the same units of space, which will be uniformly described in *one* unit of the time with the velocity generated, by the force acting uniformly during *that* unit. It is twice the space actually described by the body during that unit when impelled from rest by the accelerating force. It is necessary to keep hold of these clear ideas of the quantities expressed by the symbols.

On the other hand, when the measure of the accelerating force is previously known, we employ the theorem $at = v'$; that is, the addition made to the velocity during the whole or any part of the time of the action of the force is obtained by multiplying the acceleration of one unit of time by the number of such units contained in t' .

These are evidently leading theorems in dynamics, because all the mechanical powers of nature come under the predicament of accelerating or retarding forces. It is the collection of these in any subject, and the manner in which they accompany or are inherent in it, which determine the mechanical character of that subject; and therefore the phenomena by which they are brought into view are the characteristic phenomena. Nay, it may even be questioned whether the phenomena bring any thing more into view. This force, of which we speak so familiarly, is no object of distinct contemplation; it is merely

a something that is proportional to $\frac{dv}{dt}$. And when we observe that the $\frac{dV}{dI}$, found in the motions that result from

the vicinity of a body A , is double of the $\frac{dv}{dt}$ which results from the vicinity of another body B , we say that a force resides in A , and that it is double of the force residing in B . The accelerations are the things immediately and truly expressed by these symbols. And the whole science of dynamics may be completely taught without once employing the word *force*, or the conception which we imagine that we form of it. It is of no use till we come to study the mechanical history of bodies. Then, indeed, we must have some way of expressing the fact,

that an acceleration = $\frac{32 \text{ feet}}{1''}$ is observed in every thing on the surface of this globe; and that an acceleration = $\frac{418 \text{ feet}}{1''}$ is observed over all the surface of the sun.

These facts are characteristic of this earth and of the sun; and we express them shortly by saying that such and such forces reside in the earth and in the sun. It will preserve us from many mistakes and puzzling doubts, if we resolutely adhere to this meaning of the term *force*; and this will carry mathematical evidence through the whole of our investigations.

84. As velocity is not an immediate object of contemplation, and all that we observe of motion is a space and a time, it may be proper to give an expression of this measure of accelerating force which involves no other idea. Supposing the body to have been previously at rest, we

Is an abstract number.

Measure of a change of velocity.

These measures express the greatest part of our knowledge of mechanical nature.

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have $a \doteq \frac{v}{t}$. Multiply both parts of the fraction by t which does not change its value, and we have $a \doteq \frac{vt}{t^2}$.

But $vt = s$; and therefore $a \doteq \frac{s}{t^2}$.

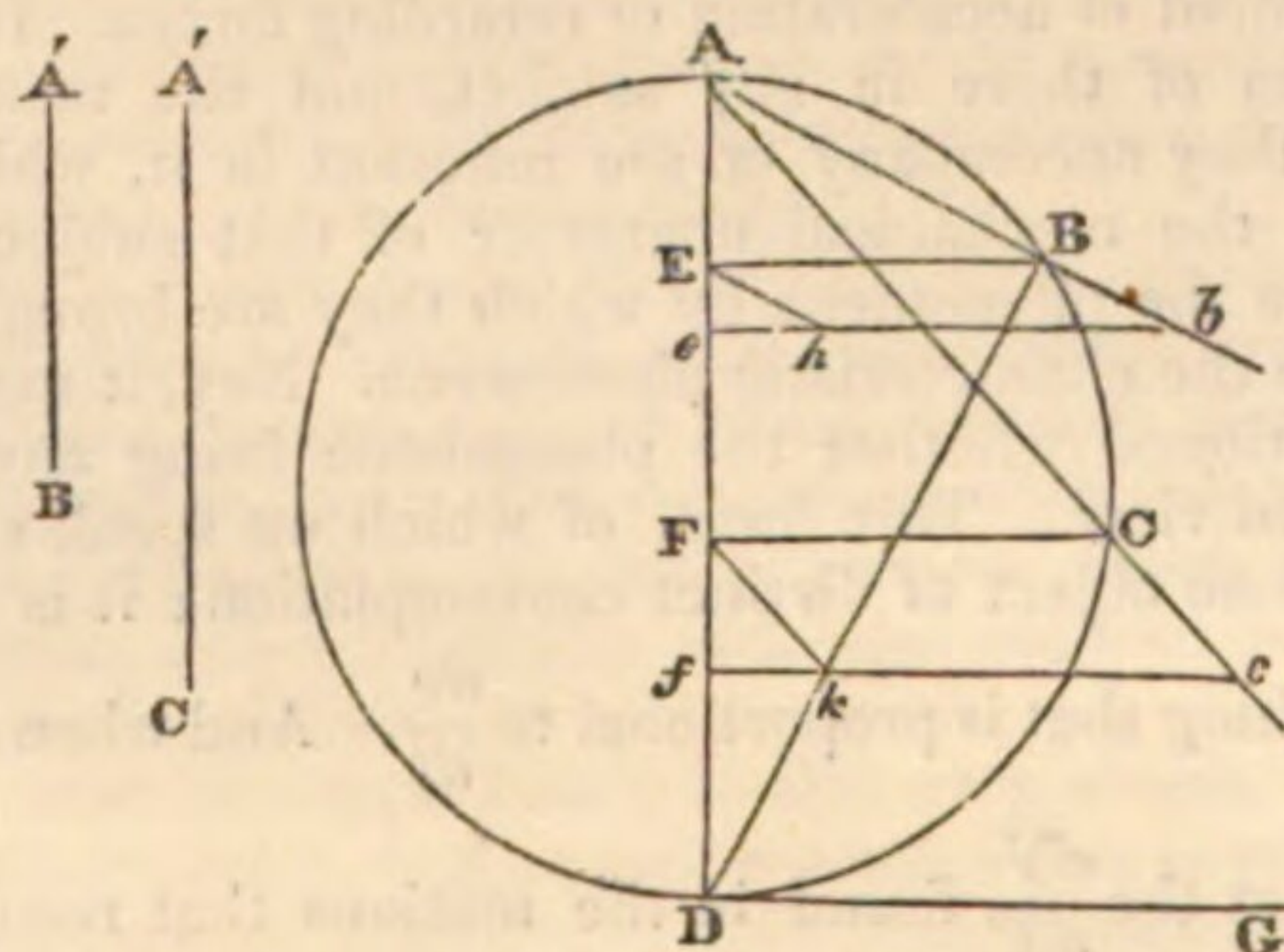
The formula $a = \frac{s}{t^2}$ is equivalent to the proportion $t^2 : 1 :: s : a$; and a would then be the space through which the accelerating force would impel the body in one unit of the time t . But this is only half of the measure of the velocity which the accelerating force generates during that unit of time. For this reason we did not express the accelerating force by an ordinary equation, but used the symbol $\doteq$. In this case, therefore, of uniform action, we may express the accelerating force by $a = \frac{2s}{t^2}$.

85. The following theorem is of still more extensive use in all dynamical disquisitions.

Most general measure of accelerating force.

Accelerating forces are proportional to the momentary increments of the squares of the velocities directly, and as the spaces along which they are uniformly acquired inversely.

Fig. 16.



Let A'B, A'C, and AD (fig. 16) be three lines, described in the same or equal times by the uniform action of accelerating forces; the motions along these lines will be uniformly accelerated, and the lines themselves will be proportional to the forces, and may be employed as their measures. On the greatest of them, AD, describe the semicircle ABCD, and apply the other two lines A'B, A'C as chords AB, AC. Draw EB, FC perpendicular to AD. Take any small portions Bb, Cc of AB and AC, and draw be, cf perpendicular to AD, and Eh and Fk parallel to AB and AC.

Then, because the triangles DAB and BAE are similar, we have $AD : AE = AD^2 : AB^2$. And because AD is to AB as the velocity generated at D is to the velocity generated at B (the times being equal), we have AD to AE as the square of the velocity at D to the square of the velocity at B; which we may express thus:

$$AD : AE = V^2 : v^2, D : B.$$

For the same reasons we have also

$$AD : AF = V^2 : v^2, D : C. \text{ Therefore}$$

$$AE : AF = V^2 : v^2, B : C.$$

But because in any uniformly accelerated motion, the spaces are as the squares of the acquired velocities, we have also

$$AE : Ae = V^2 : v^2, B : Bb, \text{ and}$$

$$AF : Af = V^2 : v^2, C : Cc.$$

Therefore Ee is to Ff as the increment of the square of the velocity acquired in the motion along Bb to the increment of the square of the velocity acquired along Cc.

But by similarity of the triangles ABD and Eeh, we have

$$AB : AD = Ee : Eh; \text{ and in like manner,}$$

$$AD : AC = Ff : Fk. \text{ Therefore}$$

$$AB : AC = Ee \times Fk : Ff \times Eh.$$

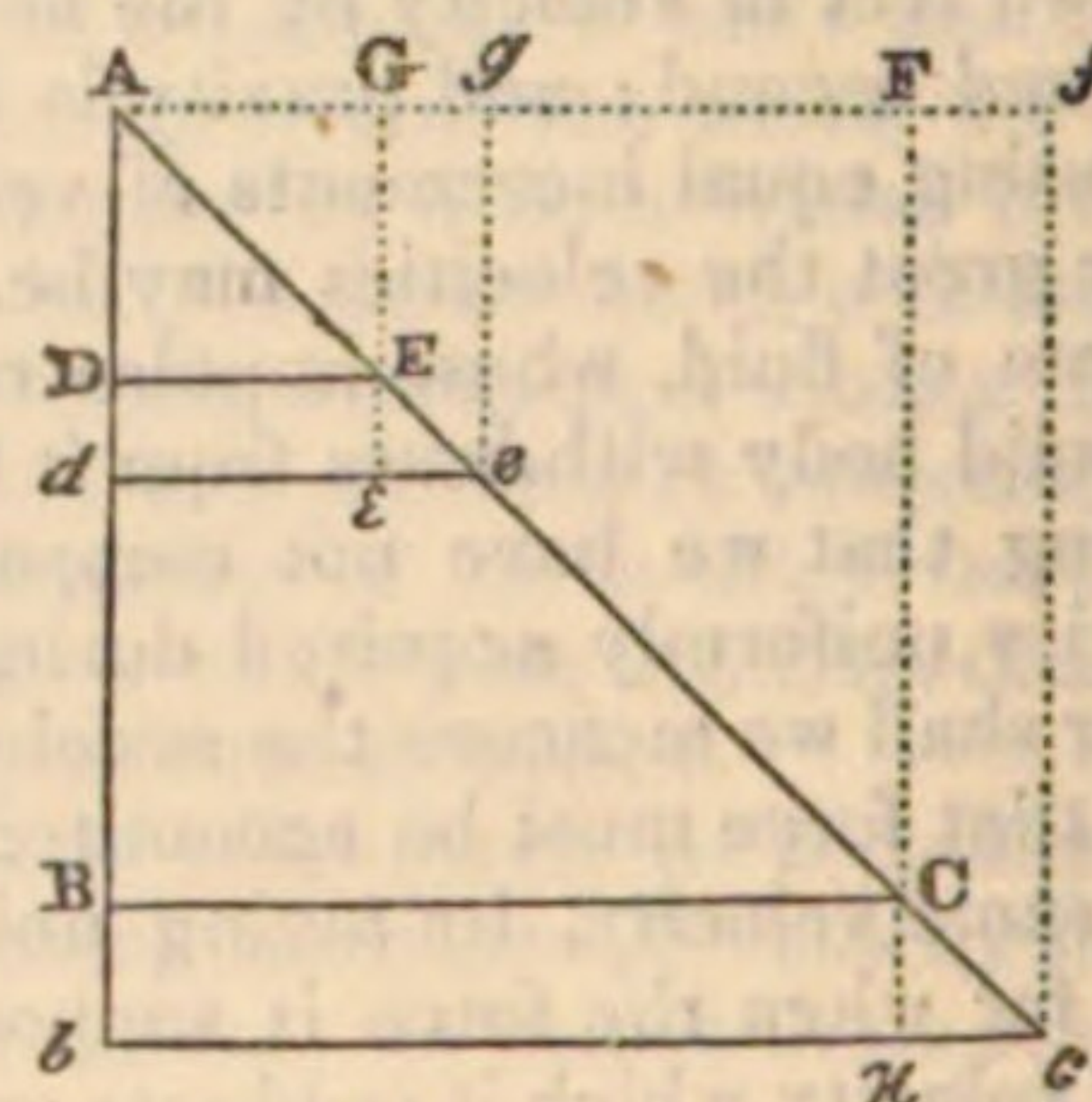
Now AB and AC are proportional to the forces which accelerate the body along the lines A'B and A'C; Ee and Ff are proportional to the increments of the squares of the velocities acquired in the motions along the portions Bb and Cc; and Eh and Fk are equal to those portions respectively. The ratio of AB to AC is compounded of the direct ratio of Ee to Ff, and the inverse ratio of Eh to Fk. The proposition is therefore demonstrated.

The proportion may be expressed thus:

$$AB : AC = \frac{Ee}{Eh} : \frac{Ff}{Fk}, \text{ and may be expressed by the}$$

proportional equation $AB \doteq \frac{Ee}{Eh}$, or symbolically, $a \doteq \frac{d(v^2)}{ds}$.

Fig. 17.



REMARK.—Because the motion along any of these vdv is but one half of the increment of v^2 .

three lines is uniformly accelerated, the relation between spaces, times, and velocities, may be represented by means of the triangle ABC (fig. 17); where AB represents the time, BC the velocity, and ABC the space. If BC be taken equal to AB, the triangle is half of the square ABCF of the velocity BC; and the triangle ADE is half of the square ADEG of the velocity DE. Let Dd and Bb be two moments of time, equal or unequal. Then DdeE and BbcC are half the increments of the squares of the velocities DE and BC, acquired during the moments Dd and Bb. It was demonstrated that the ratio of the area DdeE to the area BbcC is compounded of the ratio of DE to BC, and the ultimate ratio of Dd to Bb. But Dd and Bb are respectively equal to ϵ and κ . Therefore DdeE is to BbcC, in the ratio compounded of the ratio of DE to BC, and the ultimate ratio of ϵ to κ . If we represent DE and BC by V and v, then ϵ and κ must be represented by V' and v', the increments of V and v; and then the compound ratio will be the ratio of VV' to vv'; and if we take the ultimate ratio of the moments, and consequently the ultimate ratio of the increments of the velocities, we have the ratio of VdV to vdv. If therefore V² and v² represent the squares of the velocities, VdV and vdv will represent, not the increments of those squares, but half the increments of them.

We may now represent this proposition concerning accelerating forces by the proportional equation $a \doteq \frac{vdv}{ds}$; and we must consider this as equivalent with $a = \frac{V^2 - v^2}{2(S - s)}$;

keeping always in mind that a, V, and v, relate to the same units of time and space, and that a is that number of units of the scale on which S and s are measured, which is run over in one unit of time.

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Measure of gravity considered as an accelerating force.

This will be more clearly conceived by taking an example. Let us ascertain the accelerative power of gravity, supposing it to act uniformly on a body. Let the spaces be measured in feet and the time in seconds. It is a matter of observation, that when a body has fallen 64 feet, it has acquired a velocity of 64 feet per second; and that when it has fallen 144 feet, it has acquired the velocity of 96 feet per second. We want to determine what velocity gravity communicated to it by acting on it during one second. We have $V^2 = 9216$, and $v^2 = 4096$; and therefore $V^2 - v^2 = 5120$. $S = 144$, and $s = 64$, and

$$S - s = 80, \text{ and } 2(S - s) = 160. \text{ Now } a = \frac{5120}{160} = 32.$$

Therefore gravity has generated the velocity 32 feet per second by acting uniformly during one second.

86. *The augmentation of the square of the velocity is proportional to the force and to the space jointly.* For, because

$$a = \frac{v dv}{ds}, \text{ we have } ads = v dv.$$

Thus we learn, that a given force, acting uniformly on a body along a given space, produces the same increment of the square of the velocity, whatever the previous velocity may have been. Also, in the same manner as we formerly found that the augmentation of the velocity was proportioned to the time during which the force has acted, so the augmentation of the square of the velocity is proportional to the space along which it has acted.

Theorems respecting retarding forces.

It is pretty plain, that all that we have said of the uniform action of an *accelerating* force may be affirmed of a *retarding* force, taking a diminution or decrement of velocity in place of an increment. A uniformly retarded motion is that in which the decrements of velocity in equal terms are equal, and the whole decrements are proportional to the whole times of action. Such a motion is the indication of a constant or invariable force acting in a direction opposite to that of the motion. We conceive this to be the case, when an arrow is shot perpendicularly upwards; its weight is conceived as a force continually pressing it perpendicularly downwards.

In such motions, however great the initial velocity may be, the body will come to rest; because a certain determined velocity will be taken from the body in each equal successive moment, and some multiple of this will exceed the initial velocity. Therefore the velocity will be extinguished before the end of a time that is the same multiple of the time in which the velocity was diminished by the quantity above mentioned. It is no less evident that the time in which any velocity will be extinguished by an opposing or retarding force, is equal to the time in which the same force would generate this velocity in the body previously at rest. Therefore,

87. (1.) The times in which different initial velocities will be extinguished by the same opposing force are proportional to the initial velocities.

88. (2.) The distances to which the body will go till the extinction of its velocity, are as the squares of the initial velocities.

(3.) They are also as the squares of the times elapsed.

89. (4.) The distance to which a body, projected with any velocity, will go till its motion be extinguished by the uniform action of a retarding force, is one half of the space which it would describe uniformly during the same time with the initial velocity.

Forces generally variable in their intensity.

It very rarely happens that the force which accelerates the body acts uniformly, or with an unvaried intensity. The attraction of a magnet, for example, increases as the iron approaches it. The pressure of a spring diminishes as it unbends. The impulse of a stream of water or wind diminishes as the impelled surface retires from it by yield-

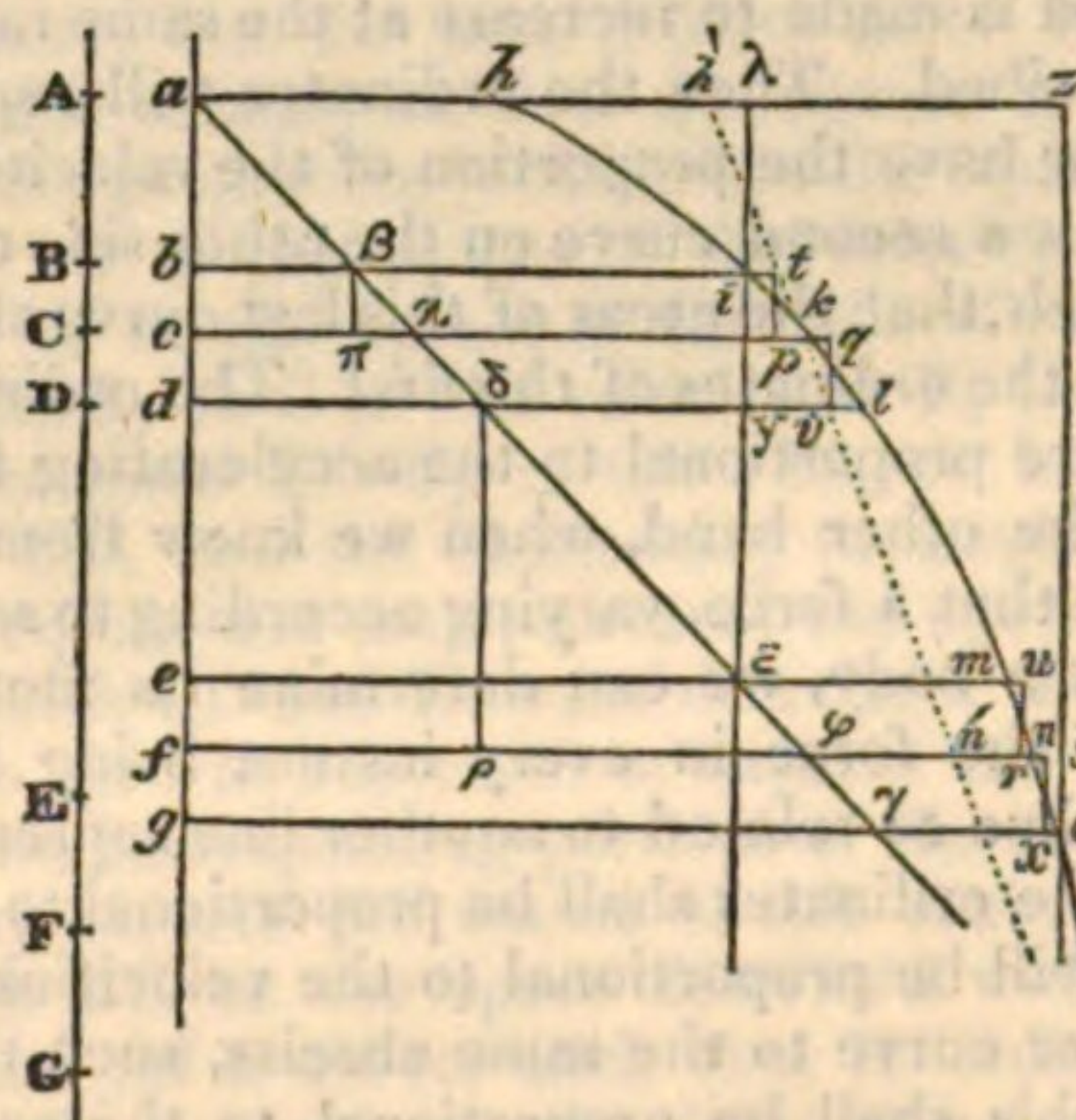
ing. Therefore the effects of accelerating forces are very imperfectly explained, till we have shown what motions result from any given variation of force, and how to discover the variation of force from the observed motion. This last question is perhaps the most important in the study of mechanical nature. It is only thus that we learn what is usually called *the nature of a mechanical force*. This chiefly consists in the relation subsisting between the intensity of the force and the distance of the substance in which it resides. Thus the nature of that power which produces all the planetary motions, is considered as ascertained, when we have demonstrated that its pressure or intensity is inversely as the square of the distance from the body in which it is supposed to reside.

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Acceleration expresses some relation of the velocity and time. This relation may be geometrically expressed in a variety of ways. In fig. 18 the uniform acceleration, or the unvaried relation between the velocity and the time, is very aptly expressed by the constant ratio of the ordinates and abscisses of the triangle agv . The ratio of dd to ad is the same with that of ee to ae , or that of ff to af , &c.; or the ratio of the increment of velocity $\pi\lambda$ to the increment of the time $\beta\pi$ or bc , or that of φ to u , &c.

This ratio $\pi\lambda : \beta\pi$ is equivalent to the symbol $\frac{dv}{dt}$.

Fig. 18.



But when the spaces described in a varied motion are represented by the areas bounded by a curve line hko , we no longer have that constant ratio of the increments of the ordinates and abscisses.

90. Therefore, in order to obtain measures of the accelerating forces, or at least of their proportions, let the abscissa ag (fig. 18) of the line hko again represent the time of a motion. But let the areas bounded by parallel ordinates now represent the velocities; that is, let the whole area increase during the time ag at the same rate with the velocities of the motion along the line AG . In this case the ordinates bi , ck , dl , &c. will be as the accelerations at the instants b , c , d , &c. or in the points B , C , D , &c.

This is demonstrated in the same way as the former proposition (No. 72). If the accelerating force be supposed constant during any two equal moments bc and fg , the rectangles $bcpt$ and $fgxs$ would express the increments of velocity uniformly acquired in equal times, and their bases cp and fs would have the ratio of the accelerations, or of the accelerating forces. But as the velocities expressed by the figure increase faster than the times during every moment, the force at the instant c is to the force at the instant f in a greater ratio than that of cp to fs ; but, for similar reasons, it is in a less ratio than that of cq to fr ; and therefore (as in the other proposition) the force at the instant c is to the force at the instant f as ck to fn .

91. *Cor.* Because cp is to fs in the ratio compounded of

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$$A : a = \frac{dV}{dT} : \frac{dv}{dt}.$$

Or by the proportional equation $a \div \frac{dv}{dt}$. Also $adt \div dv$,

and $\int adt = v$. And thus do these theorems extend even

to the cases where there cannot be observed an immediate measure either of velocity or of acceleration, because neither the space nor the velocity increases uniformly.

The theorem $a \div \frac{dv}{dt}$ is employed when we would discover the variation in the intensity of some natural power.¹ We observe the motion, and represent it by a figure analogous to fig. 18, where the abscissa represents the times, and the area is made to increase at the same rate with the spaces described. Then the ordinates will represent the velocities, or have the proportion of the velocities. Then we may draw a second curve on the other side of the same abscissa, such that the areas of this last curve shall be proportional to the ordinates of the first. The ordinates of this last curve are proportional to the accelerating forces.

92. On the other hand, when we know from other circumstances that a force, varying according to some known law, acts on a body, we can determine its motion. The intensity of the force in every instant being known, we can draw a line so related to another line representing the time, that the ordinates shall be proportional to the forces. The areas will be proportional to the velocities. We can draw another curve to the same absciss, such that the ordinates of this shall be proportional to the areas of the other, that is, to the velocities of the motion. The areas of this second curve will be proportional to the spaces described.

All these theorems relate to changes of velocity; by which means they indicate immediately the operation of natural powers.

93. We must now observe, that all that has been said concerning the effects of accelerating forces continually varying, relates to *changes* of motion, independent of what the absolute motions may be. The areas of the line whose ordinates represent the velocities do not necessarily represent the spaces described, but the change made on the spaces described in the same time; not the motions, but the changes of motion. If, indeed, the body be supposed to be at rest when the forces begin to act, these areas represent the very spaces that are passed over, and the ordinates are the very velocities. In every case, however, the accelerations are the real increments of the velocities.

This circumstance gives a great extension to our theorems, and enables us to ascertain the disturbances of any species of regular motion, apart from the motions themselves, and thus avoid a complication which would frequently be inextricable in any other way. And this process, which is merely mathematical, is perfectly conformable to mechanical principles. It is in fact an application of the doctrine of the composition of motion; a doctrine

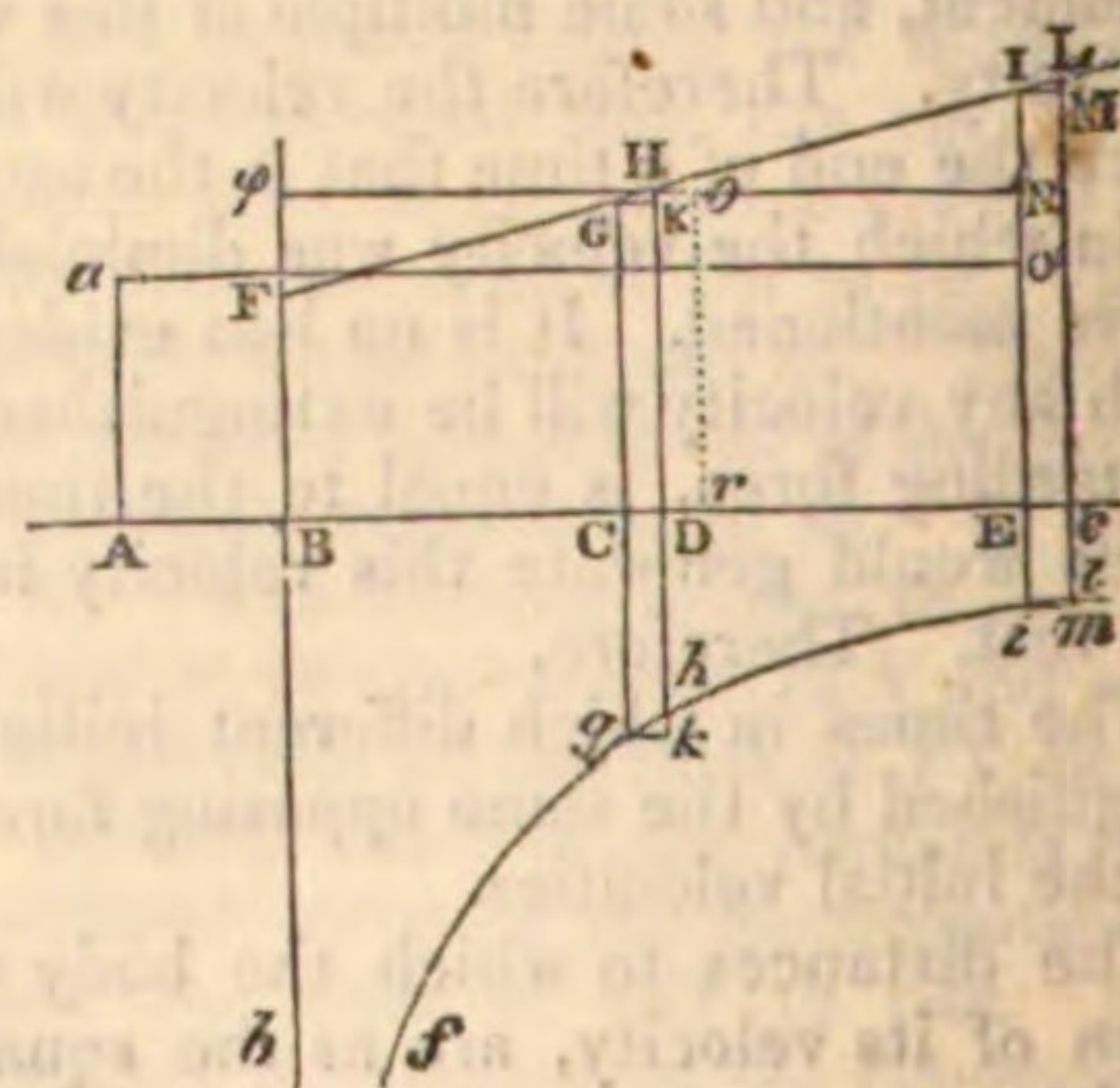
rigidly demonstrated when we measure a mechanical force by the *change* of motion which it produces. Acceleration is the continual composition of a new motion with the motion already produced.

We may learn from this investigation of the value of an accelerating force, that no finite change of velocity is effected in an instant by the action of an accelerating force. When the fig. 18 is used for the scale of accelerations, and they are represented by the ordinates of the line hko , the increment of velocity is represented by an area, that is, by a slip of the whole area; which slip must have some altitude, or must occupy some portion of the abscissa which represents time. Some portion of time, however small it may be, must elapse before any measurable addition can be made to the velocity. The velocity must change *continually*. As no motion can be conceived as instantaneous, because this would be to conceive that in one instant the moving particle is in every point of its momentary path,—so no velocity can change, by a finite quantity, in one instant, because this would be to conceive that in that instant the particle had all the intervening velocities. The instant of change is at once the last instant of the preceding velocity, and the first of the succeeding, and therefore must belong to both. This cannot be conceived, or is absurd. As a body, in passing from one part of space to another, must pass in succession through all the intermediate places; so, in passing from one velocity to another, it must in succession have all the intermediate velocities. It must be *continually* accelerated—we must not say *gradually*—however small the steps.

But to return from this digression:

94. The most frequent cases which come under examination do not show us the relation between the forces and times, but the relation between the forces and spaces. Thus, when a piece of iron is in the neighbourhood of a magnet, or a planet is considered in the neighbourhood of the sun, a force is acting on it in every point of its path, and we have discovered that the intensity of this force varies in a certain proportion. Thus, a spring varies in its pressure as it unbends; gunpowder presses less violently as it expands, &c. &c.

Fig. 19.



Our knowledge is generally confined to some such effect as this. We know, that while a body is moving along a line, ADE (fig 19), it is urged forward by a force, of which the intensity varies in the proportion of the ordinates BF, CG, DH, EI, &c. of the line FGHI.

To investigate the motion or change of motion produced by the action of this force, let CD be supposed a very small portion of the space s , which we may express by s' . Draw GK perpendicular to DH. Then, if we suppose that the

¹ See Barrow's *Lect. Geometr.* passim.

Of Accelerating and Retarding Forces. force acts with the unvaried intensity CG through the whole space CD, the rectangle CDKG will express half of the increment of the square of the velocity (No. 85). We may suppose that the force acts uniformly along the adjoining small space Dr with the intensity DH. The rectangle DHor will in like manner express another half increment of the square of the velocity. And in like manner we may obtain a succession of such increments. The aggregate or sum of them all will be half the difference between the square of the velocity at B and the square of the velocity at E.

If we employ f to express the indetermined or variable intensity of the accelerating force, and v to express the variable velocity, and v' its increment uniformly acquired, then the rectangle CDKG will be expressed by fs' . We have seen that this is equal to vv' . Therefore, in every case where we can tell the aggregate of all the quantities fs , it is plain that we will obtain half the difference between the squares of the velocities in B and E, on the supposition that the intensity of the force was constant along each little space, and varied by starts. Then, by increasing the number and diminishing the magnitude of those little portions of the space without end, it is evident that we terminate in the expression of the real state of the case, *i. e.* of a force varying continually; and that in this case the aggregate of these rectangles occupies the whole area AEIF, and is equivalent to the fluent of fds , or to the symbol $\int fds$, used to express this fluent, which is conceived an aggregate of small rectangles fs' . And we see that this area expresses half of the augmentation of the square of the velocity. Therefore,

95. If the abscissa AE (fig. 19) of a line FGI is the path along which a body is urged by an accelerating force, and if the ordinates BF, CG, DH, &c. are proportional to the forces acting in the points B, C, D, &c. the intercepted areas BCGF, BEIF, &c. are proportional to the augmentations of the square of the velocity.¹

Observe that the areas BCGF and DEIH are also proportional to the augmentations made on the squares of the velocities in B and in D.

Observe also, that it is indifferent what may have been the original velocity. The action of the forces represented by the ordinates make always the same addition to its square; and this addition is half the square of the velocity which those forces would generate in the body by impelling it from rest in the point A.

96. Lastly, on this head, observe, that we can state what constant or variable force will make the same augmentation of the square of the velocity by impelling the body uniformly along the same space BE, or along what space a given force must impel the body in order to produce the same increase of the square of its velocity. In the first case, we have only to make a rectangle BEN ϕ , equal to the area BEIF, and then B ϕ is the intensity of the constant force wanted. In the second case, in which the force EO is given, we must make the rectangle A α OE equal to the area BEIF, and AE is the space required.

Converse. 97. The converse of this proposition, viz. if the areas are as the increments of the square of the velocity, the ordinates are as the forces, is easily demonstrated in the same way; for if the elementary areas CDKG and EIME represent increments of the squares of the velocity, the accelerating forces are in the ratio compounded of the direct ratio of these rectangles and the inverse ratio of their altitudes, because these altitudes are the increments of the space (No. 85). Now the base CG of the rectangle CDKG is to the base EI of the rectangle EIME in the

same compounded ratio; therefore the force in C is to the force in E as CG to EI.

98. The line hko (fig. 18) was called by Dr Barrow (who first introduced this extensive employment of motion into geometry) the *SCALE of velocities*; and the line FHL (fig. 19) was named by him the *scale of accelerations*. Hermann, in his *Phoronomia*, calls it the *scale of force, velocity, city, acceleration, time, &c.* We shall retain this name, and we may call hko of fig. 18 the *scale of accelerations*, when the areas represent the velocities. Sir Isaac Newton added another scale of very great use, viz. a scale of times. It is constructed as follows.

99. Let ABE (fig. 19) be the line along which a body is accelerated, and let FHI be the scale of forces, that is, having its ordinates FB, HD, IE, &c. proportional to the forces acting at B, D, E, F, &c.; let fhi be another line so related to ABE, that Cg is to Ei in the inverse subduplicate ratio of the area BFGC to the area BFIE; or, to express it more generally, let the squares of the ordinates to the line fgi be inversely as the areas of the line FHI intercepted between these ordinates and the first ordinate drawn through B; then the times of the bodies moving from a state of rest in B are as the intercepted areas of the curve fgi .

For let CD and Ee be two very small portions of the space described in equal times. They will be ultimately as the velocities in C and E. The area FBCG is to the area FBEI as the square of Ei to the square of Cg (by construction); but the area FBCG is to FBEI as the square of the velocity at C to the square of the velocity at E (by the proposition); therefore the square of the velocity at C is to the square of the velocity at E as the square of Ei to the square of Cg ; therefore Ei is to Cg as the velocity at C to the velocity at E, that is, as CD to Ee: but since $Ei : Cg = CD : Ee$, we have $Ei \times Ee = Cg \times CD$, and the elementary rectangles $CgkD$ and $Eime$ are equal, and may represent the equal moments of time in which CD and Ee were described. Thus the areas of the line fgl will represent or express the times of describing the corresponding portions of the abscissa.

We may express the nature of this scale more briefly thus. Let BE be the space described with any varied motion, and fgl a curve, such that its ordinates are inversely as the velocities in the different points of the abscissa, then the area will be as the times of describing the corresponding portions of the abscissa.

100. In all the cases where our mathematical knowledge enables us to assign the values of the ordinates of the figure 19, we can obtain the law of action of the forces, or the nature of the force; and where we can assign the value of the areas from our knowledge of the proportions of the ordinates or forces, we can ascertain the velocities of the motion. We shall give an example or two, which will show the way in which we avail ourselves of the geometrical properties of figure in order to ascertain the effects of mechanical forces.

(1.) In fig. 19, let the accelerating force which impels the body along the line AB be constant, and let the body be previously at rest in B; the line which bounds the ordinates that represent the forces must be some line ϕ HN parallel to AB. The area BDH ϕ is to the area BEN ϕ as the square of the velocity at D to the square of the velocity at E. These areas, having equal bases DH and EN, are as their altitudes BD and BE; that is, the spaces described are as the squares of the acquired velocities. And we see that this characteristic mark of uniformly accelerated motion is included in this general proposition.

¹ Newton's *Principia*, i. 39.

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of action of a bowstring, and of all elastic bodies, when their change of figure during their mutual action is moderate; and it has been by the help of this proposition first demonstrated in a particular case by Lord Brouncker and Mr Huygens, that we have been able to obtain precise measures of time, and consequently of actual motions, and consequently of any of the mechanical powers of nature. It is for this reason, as well as for the easy and perspicuous employment of the mathematical method of proceeding, that we have selected it.

Instead of giving any more particular cases, we may observe in general, that if the intensity of the force be proportional to any power whose index is $n-1$ of the distance, and if a be the distance from the fixed point at which the body begins to be accelerated, and x its distance from the point in any part of the motion, the velocity will be $\div \sqrt{a^n - x^n}$. This is very plain, because the increment CGHD of the area of fig. 19, which is also the increment of the square of the velocity, is $\div x^{n-1}dx$, and the area is $\div x^n$; and the whole area, corresponding to the distance a , is a^n . Therefore the portion of the area lying beyond the distance x is $a^n - x^n$. This is as the square of the velocity, and therefore the velocity is as the square root $\sqrt{a^n - x^n}$ of this quantity.

This proposition, $f ds \div v dv$, or $f \div \frac{v dv}{ds}$, is the 39th of the first book of Newton's *Principia*, and is perhaps the most important in the whole doctrine of dynamics, whether employed for the investigation of forces or for the explanation of motions. It furnishes the most immediate data for both purposes, but more especially for the last. By its help Sir Isaac Newton was able to point out the numerous disturbances of the planetary motions, and to separate them from each other; thus unravelling, as it were, that most intricate motion in which all are blended together. He has given a most wonderful specimen of its application in his Lunar Theory.

We now are able to explain all the puzzling facts which were adduced by Leibnitz and his partisans in support of their measure of the forces of bodies in motion. We see why four springs, equally bent, communicate but a double velocity, and nine springs but a triple velocity; why a bullet moving twice as fast will penetrate an earthen rampart to a quadruple depth, &c. &c.

Conservatio virium vivarum.

This theorem also gives a most perspicuous explanation of the famous doctrine called *conservatio virium vivarum*. When perfectly elastic bodies act on each other, it is found that the sum of the masses multiplied by the squares of the velocities is always the same. This has been substituted, with great encomiums, by the German philosophers, in place of Descartes's principle, that the quantity of motion in the universe, estimated in one direction, remains always the same. They are obliged, however, to acknowledge, that in the actions of perfectly hard bodies, there is always a loss of *vis viva*, and therefore have denied the existence of such bodies. But there is the same loss in the mutual actions of all soft or ductile, or even imperfectly elastic, bodies; and they are miserably puzzled how to explain the fact; but both the *conservatio* and the *amissio* are necessary consequences of this theorem.

In the collision of elastic bodies, the whole change of motion is produced during the short time that the bodies are compressed, and while they regain their figure. When this is completed, the bodies are at the same distance from each other as when the mutual action began. Therefore the preceding body has been accelerated, and the following body has been retarded along equal spaces; and in every point of this space the accelerating and the retarding force has been equal. Consequently the same

area of fig. 20 expresses the change made on the square of the velocity of both bodies. Therefore, if V and U are the velocities before collision, and v and u the velocities after collision, of the two bodies A and B , we must have

$$A \times \overline{V^2 - v^2} = B \times \overline{u^2 - U^2}, \text{ and therefore } A \times V^2 + B \times U^2 = A \times v^2 + B \times u^2.$$

But in the other class of bodies, which do not completely regain their figure, but remain compressed, they are nearer to each other when their mutual action is ended than when it began. The foremost body has been accelerated along a shorter space than that along which the other has been retarded. The mutual forces have in every instant been equal and opposite. Therefore the area which expresses the diminution of the square of the velocity must exceed the area expressing the augmentation by a quantity that is always the same when the permanent compression is the same; that is, when the relative motion is the same. $A \times \overline{V^2 - v^2}$ must exceed $B \times \overline{u^2 - U^2}$, and $A \times V^2 + B \times U^2$ must exceed $A \times v^2 + B \times u^2$.

This same theorem is of the most extensive use in all practical questions in mechanic arts; and without it mechanics can go no farther than the mere statement of equilibrium.

Hermann, professor of mathematics at Pavia, one of the ornaments of the mathematical class of philosophers, has given a pretty demonstration of this valuable proposition, in the *Acta Eruditorum Lipsiæ* for 1709; and says, that having searched the writings of the mathematicians with great care, he found himself warranted to say, that Newton was the undoubted author, and boasts of his own as the first synthetical demonstration. The purpose of this assertion was not very apparent at the time; but long after, in 1746, when Hermann's papers, preserved in the town-house of Pavia, were examined, in order to determine a dispute between Maupertuis and Koenig about the claim to the discovery of the principle of least action, letters of Leibnitz's were found, requesting Hermann to search for any traces of this proposition in the writings of the mathematicians of Europe. Leibnitz was by this time the envious detractor from Newton's reputation, and could not but perceive that all his contorted arguments for his doctrine received a clear explanation by means of this proposition, in perfect conformity to the usual measure of moving forces. Newton had discovered this theorem long before the publication of the *Principia*, and even before the discovery of the chief proposition of that book in 1666; for in his Optical Lectures, the materials of which were in his possession in 1664, he makes frequent use of a proposition founded on this. (See No. 42.) We may here remark, that Hermann's demonstration is in every step the same with Dr Barrow's demonstration of it as a theorem merely geometrical, without speaking of moving forces (see *Lect. Geometr.* xi. p. 85, edit. 16), but giving it as an instance of the transformation of curves, which he calls *scales* of velocity, of time, of acceleration, &c. It is very true that Barrow in these mathematical lectures approached very near to both of Newton's discoveries, the fluxionary geometry, and the principles of dynamics; and the junto on the Continent, who were his continual detractors, charge him with impudent plagiarism from Dr Barrow, and even say that he has added nothing to the discoveries of his teacher. But surely Dr Barrow was the best judge of this matter; and, so far from resenting the use which Newton has made of what he had taught him, he was charmed with the genius of the *juvenis spectatissimus* his scholar, and of his own accord gave him his professorial chair, and ever after lived in the utmost harmony and friendship with him. Nay, it would even appear

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from some expressions in those very lectures, that Dr Barrow owed to young Newton the first thought of making such extensive use of motion in geometry. We recommend this work of Barrow's to the serious perusal of our readers, who wish to acquire clear notions of the science of motion, and an elegant taste in their mechanical disquisitions. After all the cultivation of this science by the commentators and followers of Newton, after the *Phoronomia* of Hermann, the *Mechanica* of Euler, the *Dynamique* of D'Alembert, and the *Mechanique Analytique* of De la Grange, which are undoubtedly works of transcendent merit and utility, the *Principia* of Newton will still remain the most pleasing, perspicuous, and elegant specimen of the application of mathematics to the science of universal mechanics, or what we call DYNAMICS.

The two fundamental theorems $fdt = dv$, and $fds = vdv$, enable us to solve every question of motion accelerated or retarded by the action of the mechanical powers of nature. But the employment of them may be greatly expedited and simplified by noticing two or three general cases which occur very frequently.

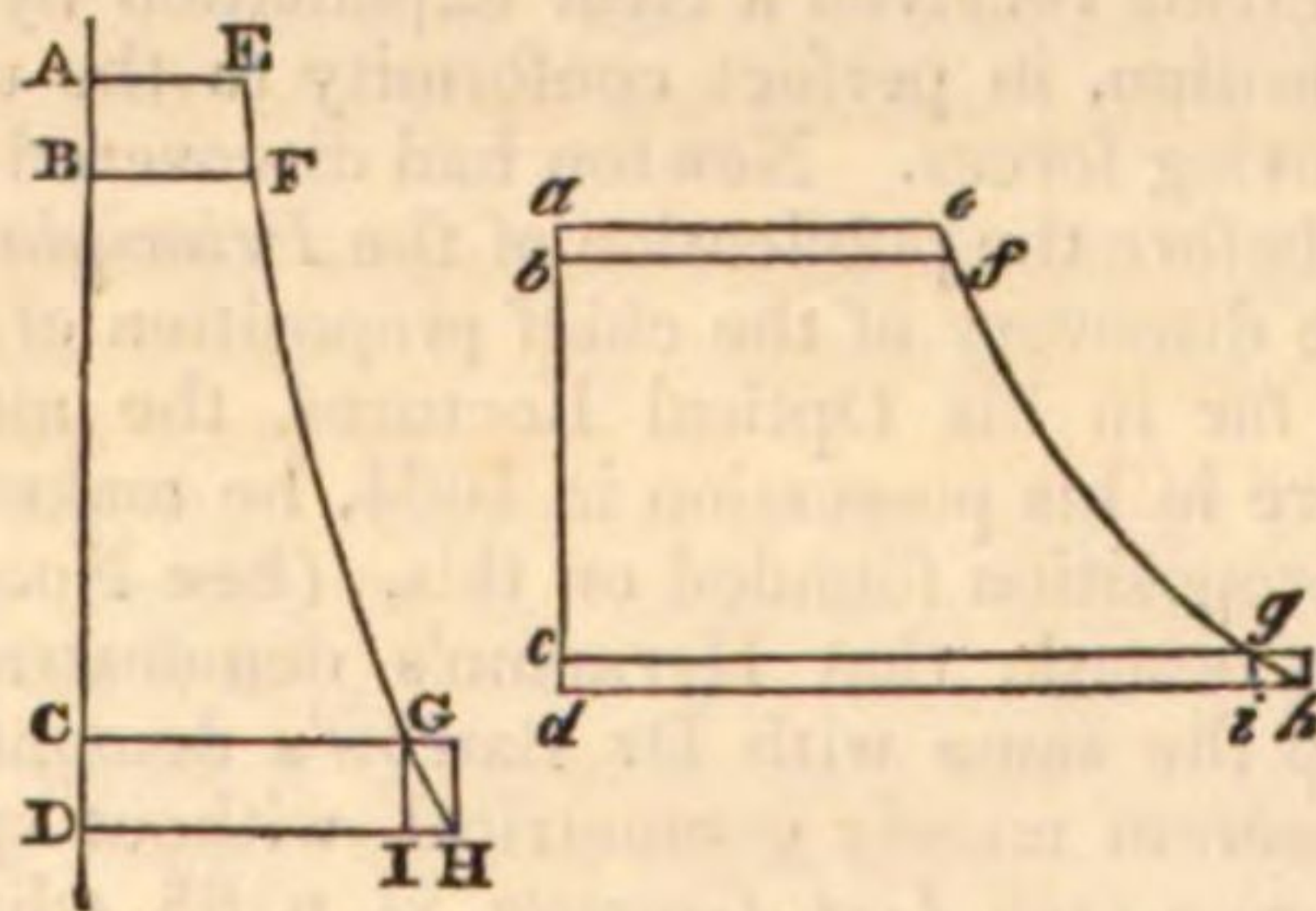
Similar instants and points, what.

104. These may be called similar instants of time, and similar points of space which divide given portions of time, and of space in the same ratio. Thus the middle is a similar instant of an hour or of a day, and is the similarly situated point of a foot or of a yard. The beginning of the 21st minute, and of the 9th hour, are similar instants of an hour and of a day. The beginning of the fifth inch, and of the second foot, are similar points of a foot and of a yard.

Similar actions, what.

105. Forces may be said to act similarly when their intensities in similar instants of time, or in similar points of space, are in a constant ratio. Thus in fig. 20, when one body is impelled towards C from A, and another from K, each with a force proportional to the distance of every point of its motion from C, these forces may be said to act similarly along the spaces AC and KC, or during the times represented by the quadrantal arches AFH, KNO. The following propositions on similar actions will be found very useful on many occasions; but we must premise a geometrical lemma.

Fig. 21.



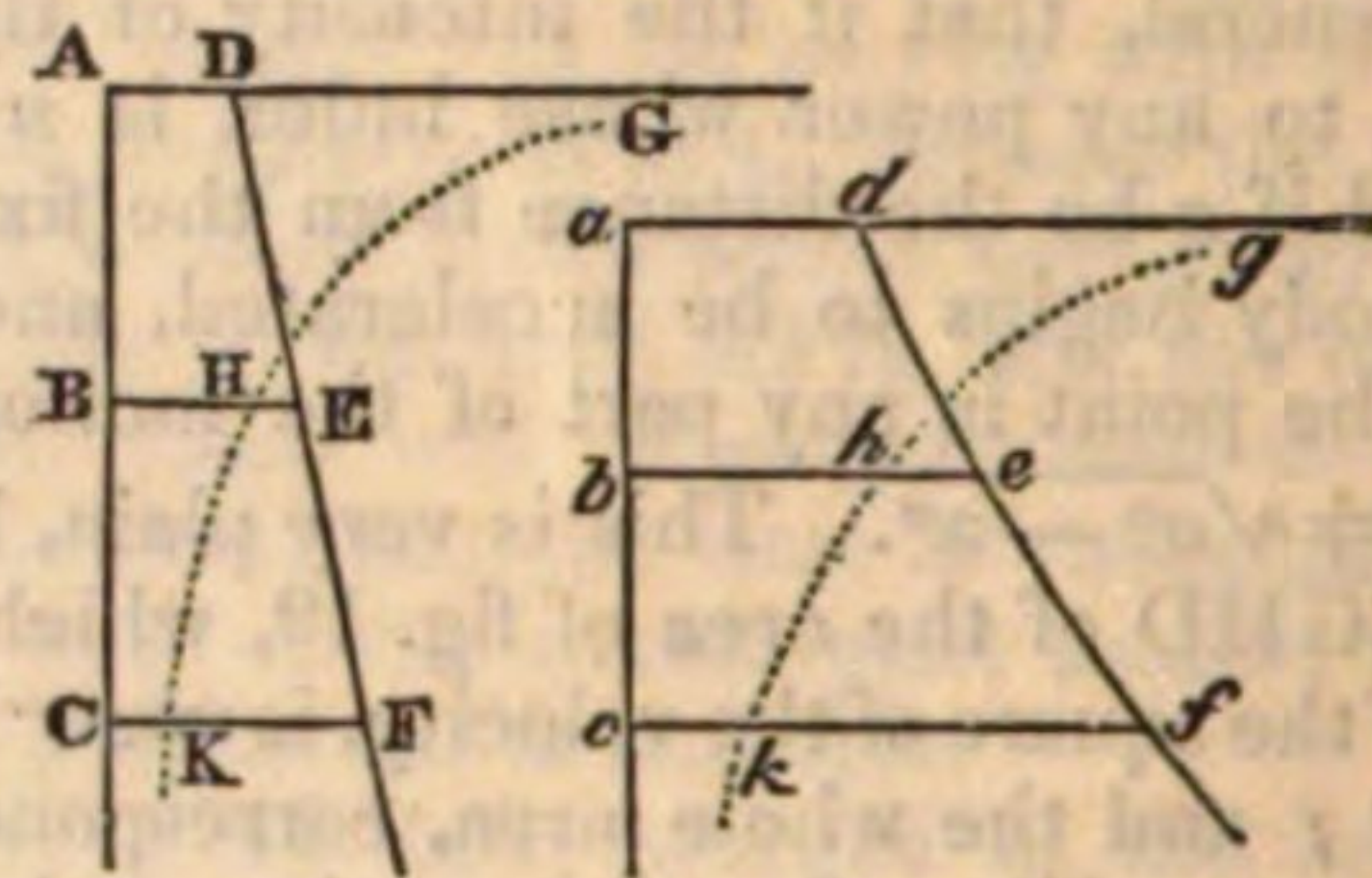
106. If there be two lines EFGH (fig. 21), $efgh$, so related to their abscisses AD, ad , that the ordinates BF, bf , drawn from similar points B and b of the abscisses, are in the constant ratio of AE to ae ; then the area ADHE is to the area $adhe$ as the rectangle of $AD \times AE$ to the rectangle $ad \times ae$.

For, let each abscissa be divided into the same number of equal and very small parts, of which let CD and cd be one in each. Inscribe the rectangles CGID, $cgid$. Then because the number of parts in each axis is the same, the lengths of the portions CD and cd will be proportional to the whole abscisses AD and ad . And because C and c are similar points, CG is to cg as AE is to ae . Therefore $CD \times CG : cd \times cg = AD \times AE : ad \times ae$. This is true of each pair of corresponding rectangles, and therefore it is

true of their sums. But when the number of these rectangles is increased, and their breadth diminished without end, it is evident that the ultimate ratio of the sum of all the rectangles, such as CDHG, to the sum of all the rectangles $cdhg$, is the same with that of the area ADHE to the area $adhe$, and the proposition is manifest.

107. If two particles of matter are similarly impelled during given times, the changes of velocity are as the times and as the forces jointly.

Fig. 22.



Let the times be represented by the straight lines ABC (fig. 22), and abc , and the forces by the ordinates AD, BE, CF, and ad , be , cf . Then if B and b are similar instants (suppose the middles) of the whole times, we have $BE : be = AD : ad$. Therefore, by the lemma, the area ACFD is to $acfd$ as $AC \times AD$ to $ac \times ad$. But these areas are proportional to the velocities (No. 72), and the proposition is demonstrated. For the same reason, the change of velocity during the time AB is to the change during ab as $AB \times AD$ to $ab \times ad$.

Cor. 1. If the times and forces are reciprocally proportional, the changes of velocity are equal; and if the forces are inversely as the times, the changes of velocity are equal.

108. If two particles be similarly urged along given spaces, the changes made on the squares of the velocities are as the forces and spaces jointly.

For if AC (fig. 22) and ac are the spaces along which the particles are impelled, and the forces are as the ordinates AD and ad , the areas ACFD and $acfd$ are as the changes on the squares of the velocities. But these areas are as $AC \times AD$, and $ac \times ad$. Therefore, &c.

Cor. 2. If the spaces are inversely as the forces, the changes of the squares of the velocities are equal; and if these are equal, the spaces are inversely as the forces.

Cor. 3. If the spaces along which the particles have been impelled from a previous state of rest, are directly as the forces, the velocities are also as the forces. For, because the changes of the squares of the velocities are as the spaces and forces jointly, they are in this case as the squares of the forces or of the spaces; but the changes of the squares of the velocities are in this case the whole squares of the velocities; therefore the squares of the velocities are as the squares of the forces, and the velocities are as the forces. N.B. This includes the motions represented in fig. 20.

109. If two particles be similarly impelled along given spaces, from a state of rest, the squares of the times are proportional to the spaces directly, and to the forces inversely.

Let ABC (fig. 22), abc , be the spaces described, and AD, ad , the accelerating forces at A and a . Let V, B express the velocity at B, and v , b the velocity at b .

Let GHK and ghk be curves whose ordinates are inversely as the velocities at the corresponding points of the abscissa. These curves are therefore exponents of the times (No. 99). Then, because the forces act similarly, we have, by the last theorem, $AC \times AD : ac \times ad = V^2 : v^2$, $B : b = hb^2 : HB^2$. Therefore $HB : hb = \sqrt{ac \times ad} : \sqrt{AC \times AD}$, and therefore in a con-

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stant ratio. Call this the ratio of m to n . But since the ordinates of the lines GHK, ghk , are inversely as the velocities, the areas are as the times (No. 99); and since these ordinates are in the constant ratio of m to n , the areas are in the ratio of $AC \times m$ to $ac \times n$. Therefore (calling the times of the motions T and t), we have

$$\begin{aligned} T:t &= m \times AC : n \times ac; \text{ and therefore} \\ T^2:t^2 &= m^2 \times AC^2 : n^2 \times ac^2. \text{ But} \\ m^2:n^2 &= ac \times ad : AC \times AD. \text{ Therefore} \\ T^2:t^2 &= ac \times ad \times AC^2 : AC \times AD \times ac^2, \\ \text{or } T^2:t^2 &= ad \times AC : AD \times ac. \end{aligned}$$

$$\text{Or } T^2:t^2 = \frac{AC}{AD} : \frac{ac}{ad}.$$

The attentive reader will observe that these three propositions give a great extension to the theorems which were formerly deduced from the nature of uniformly accelerated motion, or of uniform action of the forces, and were afterwards demonstrated to obtain in the momentary action of forces any how variable.

The first of the three propositions, $V:v = F \times T : f \times t$, is the extension of the theorem $f dt = dv$. The second, $V^2:v^2 = F \times S : f \times s$, is the extension of the theorem

$$f ds = v dv. \text{ And the third, } T^2:t^2 = \frac{S}{F} : \frac{s}{f}, \text{ is the extension of } f = \frac{ds}{d(t^2)}, \text{ or of } fd(t^2) = ds.$$

These theorems hold true of all similar actions; and, only for this reason, are true of uniformly accelerated motions, or uniform actions.

Aggregate of many equal accelerating forces.
There remains one thing more to be said concerning the action of accelerating forces. Their magnitude is ascertained by their effect. Therefore that is to be considered as a double force which produces a double quantity of motion. Therefore when a body A contains twice the number of equal atoms of matter, and acquires the same velocity from the action of the force F , that another body a , containing half the number of atoms, acquires from the action of a force f , we conceive F to be double of f . That this is a legitimate inference appears clearly from this, that we conceive the sensible weight of a body, or that pressure which it exerts on its supports, as the aggregate of the equal pressure of every atom accumulated perhaps on one point; as when the body hangs by a thread, and, by its intervention, pulls at some machine. Without inquiring in what manner or by what intervention this accumulation of pressure is brought about, we see clearly that it results from the equal accelerating force of gravity acting immediately on each atom. When this weight is thus employed to move another body by the intervention of the thread, which is attached to one point perhaps of that body, it puts the whole into motion, generating a certain velocity v in every atom, by acting uniformly during the time t . We conceive each atom to have sustained the action of an equal accelerating force whose measure is $\frac{v}{t}$. Without considering how this

force is exerted on each atom, or by what it is immediately exerted, or how it is diffused through the body from the point to which the weight of the other body is applied by means of the thread; we still consider it as the aggregate of the action of gravity on each atom of that other body. Moreover, attending only to the motion produced by it, and perhaps not knowing the weight of the impelling body, we measure it, as a moving force, by considering it as the aggregate of the forces propagated to each atom of the impelled body, and measured by $\frac{v}{t}$. If we know that

the impelled body contains the number m of atoms, the aggregate of forces is $m \frac{v}{t}$, or $\frac{mv}{t}$.
Of Deflecting Forces.

But since we measure forces by the quantity of motion which they produce, we must conceive, that when the same force is applied to a body which consists of n particles, and produces the velocity u , by acting uniformly during the same time t , the force $n \frac{u}{t}$ is equal to the force $m \frac{v}{t}$.

110. Sir Isaac Newton found it absolutely necessary, in the disquisitions of natural philosophy, to keep this circumstance of acceleration clear of all notions of quantity of matter, or other considerations, and to contemplate the affections of motion only. He therefore considered $\frac{v}{t}$ as the true original measure of accelerating force, and $m \frac{v}{t}$ as an aggregate. He therefore calls the

aggregate a *vis motrix*, a *moving force*, measured by the quantity of motion that it generates. And he confines the term *accelerating force* to the quantity $\frac{v}{t}$ measured by the acceleration or velocity only. It would be convenient, therefore, also to confine the symbol f to $m \frac{v}{t}$, and to retain the symbol a for expressing the accelerating force $\frac{v}{t}$.

This appellation of *motive force* is perfectly just and simple; for we may conceive it as the same with the accelerating force which produces the velocity m times v in one particle, by acting on it uniformly during the time t . This motion of one particle having the velocity mv , is the same with that of m particles having each the velocity v .

If therefore a motive force f act on a body consisting of m particles, the accelerating force a is $= \frac{f}{m} \frac{v}{t}$.

Therefore the three last propositions concerning the similar, the uniform, or the momentary actions of moving forces, when expressed in the most general terms, are,

$$\begin{aligned} v &\div \frac{f}{mt}, \\ v^2 &\div \frac{fs}{m}, \text{ or } v dv = \frac{f ds}{m}, \\ t^2 &\div \frac{ms}{f}. \end{aligned}$$

OF DEFLECTING FORCES.

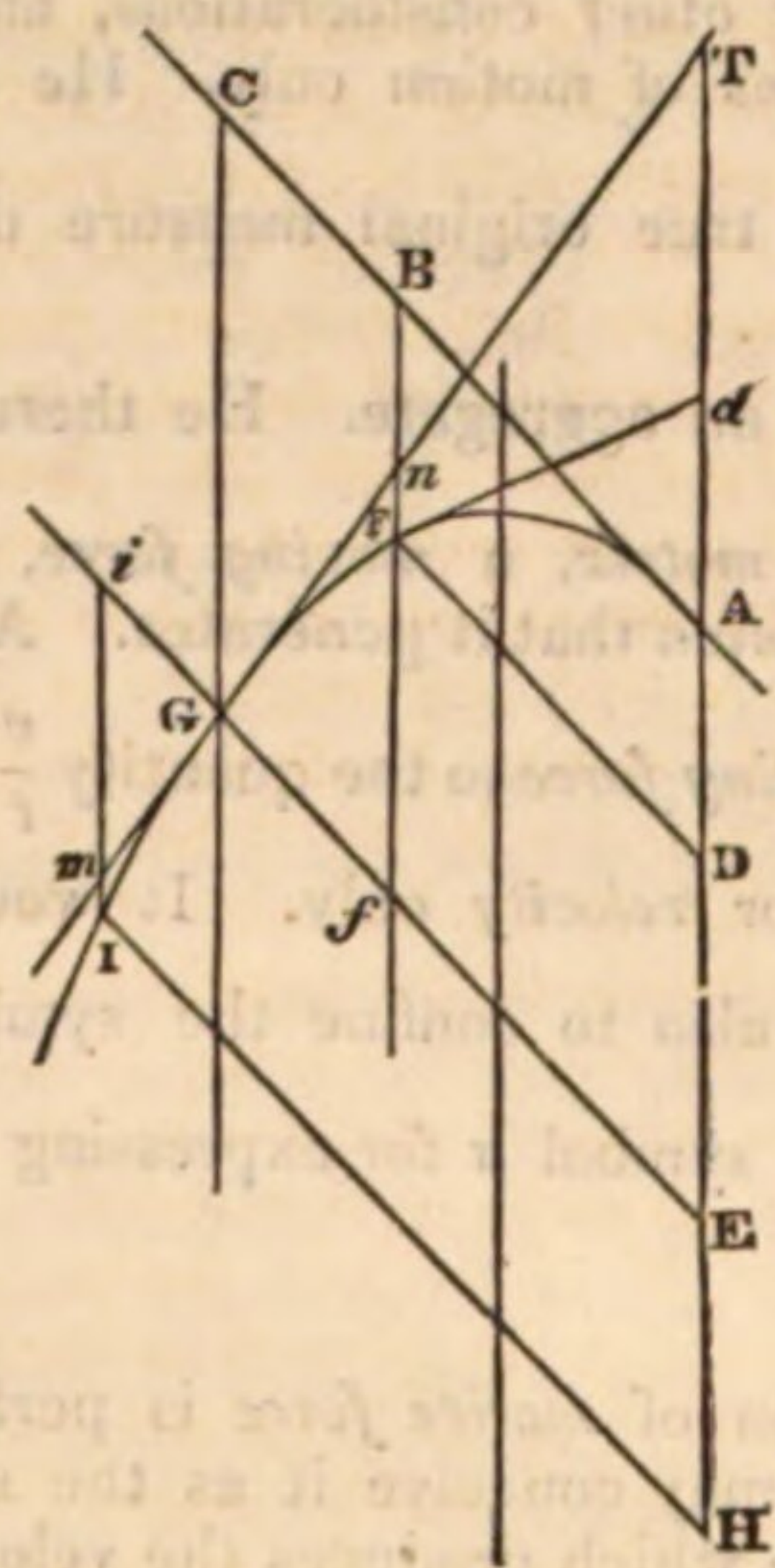
111. When we observe the direction of a body to change, we unavoidably infer the agency of a force which acts in a direction that does not coincide with that of the body's motion; and we may distinguish this circumstance by calling it a *deflecting force*. We have already shown how to estimate and measure this deflecting force, by considering it as competent to the production of that motion which, when compounded with the former motion, will produce the new motion (No. 44). Now, as all changes of motion are really compositions of motions or forces, it

Of Deflecting Forces. is evident that we shall explain the action of deflecting forces when we show this composition.

Alteration of deflections are continual, and produce curvilinear motions.

We may almost venture to say *a priori*, that all deflections must be continual, or exhibit curvilinear motions: for as no finite velocity, or change of velocity, can be produced in an instant by the action of an accelerating force, no polygonal or angular deflection can be produced; because this is the composition of a finite velocity produced in an instant. Deflective motions are all produced by the composition of the former motion, having a finite velocity, with a transverse motion continually accelerated from a state of rest. Of this we can form a very distinct notion, by taking the simplest case of such accelerated motion, namely, a uniformly accelerated motion.

Fig. 23.



Example. Determination of the path,

112. Let a body be moving in the direction AC (fig. 23) with any constant velocity, and when it comes to A, let it be exposed to the action of an accelerating force, acting uniformly in any other direction AE. This alone would cause the body to describe AE with a uniformly accelerated motion, so that the spaces AD, AE, would be as the squares of the times in which they are described. Therefore, if AB be the space which it would have described uniformly in the time that it describes AD by the action of the accelerating force, and AC the space which it would have described uniformly while it describes AE by the action of the accelerating force, nothing more is wanted for ascertaining the real motion of the body but to compound the uniform motion in the direction AC with the uniformly accelerated motion in the direction AE. AD is to AE as the square of the time of describing AD to the square of the time of describing AE; that is, as the square of the time of describing AB to the square of the time of describing AC; that is, as AB^2 to AC^2 (by reason of the uniform motion in AC). This composition is performed by taking the simultaneous points B, D, and the simultaneous points C, E, and completing the parallelograms ABFD, ACGE. The body will be found in the points F and G in the instants in which it would have been found at B and C by the uniform motion, or in D and E by the accelerated motion. In the same manner may be found as many points of the real path as we please. It is plain that these points will be in a line AFG, so related to AE that $AD : AE = DF^2 : EG^2$; or so related to the original motion AC, that $AB^2 : AC^2 = BF : CG$, &c. This line is therefore a parabola, of which AE is a dia-

meter, DF and EG are ordinates, and which touches AC in A.

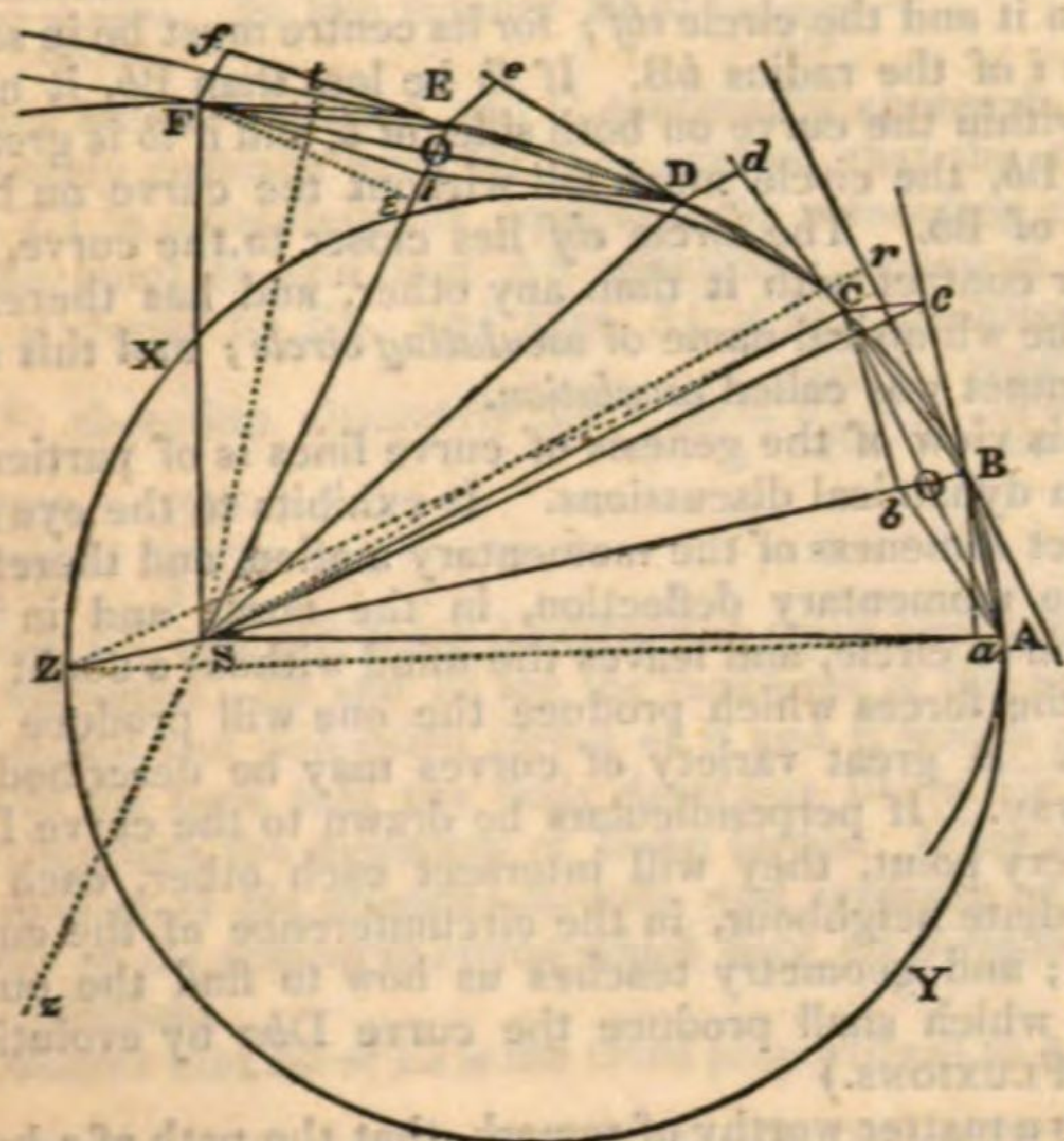
Having thus ascertained the path of the body, we can also ascertain the motion in that path; that is, the velocity in any point of it. We know that the velocity in the point G is to the velocity of the uniform motion in the direction AC as the tangent TG is to the ordinate EG; because this is the ultimate ratio of the momentary increment of the arch AFG to the momentary increment of the ordinate EG. Thus is the velocity in every point of the curve determined. We have taken it for granted that the line of projection touches the path, and that the direction in every point is that of the tangent. To suppose that the curve, in any portion of it, coincides with the tangent, is to suppose that the body is not deflected, that is, is not acted on by a transverse accelerating force; and to suppose that the tangent makes a finite angle with any part of the path, is to suppose that the deflection is not continual, but by starts, both of which are contrary to the conditions of the case. No straight line can be drawn between the direction of the body and the succeeding portion of the path, otherwise we must again suppose that the deflection is subsultory, and the motion angular.

113. But while the investigation is so easy when the direction and intensity of the deflecting force in every point of the curve are known, the investigation of the deflecting force from the observed motion is by no means easy. The observed curvilinear motion always arises from a composition of a uniform motion in the tangent with some transverse motion; but the same curvilinear motion may be produced by compounding the uniform motion in the tangent with an infinity of transverse motions, and the law of action will be different in these transverse motions according as their directions differ. We must learn not only the intensity of the deflecting force, and the law of its variation, but also its direction in every point of the curve. It is not easy to find general rules for discovering the direction of the transverse force; most commonly this is indicated by extrinsic circumstances. The deflecting force is frequently observed to reside in or to accompany some other body. It may be presumed, therefore, that it acts in the direction of the line drawn to or from that body; yet even this is uncertain. The most general rule for this investigation is to observe the place of the body at several intervals of time before and after its passing through the point of the curve, where we are interested to find its precise direction. We then draw lines joining those places of the tangent where the body would have been by the uniform motion only. We shall perhaps observe these lines of junction keep in parallel positions: we may be assured that the direction of the transverse force is the same with that of any of these lines. This is the case in the example just now given of a parabolic motion; but when these lines change position they will change it gradually, and their position in the point of contact is that to which their positions on both sides of it gradually approximate.

But all this is destitute of the precision requisite in philosophical discussion. We are indebted to Sir Isaac Newton for a theorem which ascertains the direction of the transverse force with all exactness, in the cases in which we most of all wish to attain mathematical accuracy, and which not only opened the access to those discoveries which have immortalized his name, but also pointed out to him the path he was to follow, and even marked his first steps. It therefore merits a very particular treatment.

Of Deflecting Forces. and of the motion in this path.

Fig. 24.

Of Deflect-
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Central
forces.

114. If a body describes a curve line ABCDEF (fig. 24) lying in one plane, and if there be a point S so situated in this plane that the line joining it with the body describes areas ASB, ASC, ASD, &c. proportional to the times in which the body describes the arches AB, AC, AD, &c. the force which deflects the body from rectilinear motion is continually directed to the fixed point S.

Let us first suppose that the body describes the polygon ABCDEF, &c. formed of the chords AB, BC, CD, DE, EF, &c. of this curve, and, for greater simplicity of argument, let us consider areas described in equal successive times; that is, let us suppose that the triangles ASB, BSC, CSD, &c. are equal, and described in equal times. Make $Bc = AB$, and draw cS .

Had the motion AB suffered no change in the point B, the body would have described Bc in the equal moment succeeding the first; but it describes BC. The body has therefore been deflected by an external force, and BC is the diagonal of a parallelogram (No. 45, 46), of which Bc is one side, and cC is another. The deflecting force will be discovered, both in respect of direction and intensity, by completing the parallelogram BcCb. Bb is the space which the deflecting force would have caused the body to describe in the time that it describes Bc or BC. Because Bc is equal to BA, the triangles BSc, BSA are equal. But, by the nature of the motion, BSA is equal to BSC; therefore the triangles BSC and BSc are equal. They are also on the same base BS; therefore they lie between the same parallels, and Cc is parallel to SB. But cC is parallel to Bb; therefore Bb coincides with BS, and the deflecting force at B is directed toward S. By the same argument, the deflecting force at the angles D, E, F, &c. is directed to S.

Now, let the sides of the polygon be diminished, and their number increased without end. The demonstration remains the same, and continues, when the polygon finally coalesces with the curve, and the deflection is continual.

When areas are described proportional to the times, equal areas are described in equal times; and therefore the deflection is always directed to S. Q. E. D.

The point S may, with equal propriety of language, be called the *centre of deflection*, or the *centre of forces*; and forces which are thus continually directed to one fixed point may be distinguished from other deflecting forces by the name *central forces*.

The line joining the centre of forces with the body, and which may be conceived as a stiff line carrying the body round, is usually named the *radius vector*.

115. The converse of this proposition, viz. that if the deflecting forces be always directed to S, the motion is performed in one plane, in which S is situated, and areas are described proportional to the times, is easily demonstrated by reversing the steps of this demonstration. The motion will be in the plane of the lines SB and Bc, because the diagonal BC of the parallelogram of forces is in the plane of the sides. Areas are described proportional to the times; for Cc being parallel to SB, the triangles SCB and ScB are equal; and therefore SCB and SAB are equal, &c. &c.

116. Cor. 1. When a body describes areas round S proportional to the times, or when it is continually deflected toward S, or acted on by a transverse force directed to S, the velocities in the different points A and E of the curve are inversely proportional to the perpendiculars Sr and St, drawn from the centre of forces to the tangents in those points; that is, to the perpendiculars from the centre on the momentary directions of the motion: for since the triangles ASB, ESF are equal, their bases AB, EF are inversely as their altitudes Sr, St; but these bases being described in equal times, are as the velocities, and they ultimately coincide with the tangents at A and E.

117. Cor. 2. If Ba and Fz be drawn perpendicular to SA and SE, we have $SA \times Ba = SE \times Fz$, and $SA : SE = Fz : Ba$. For $SA \times Ba$ is double of the triangle BSA, and $SE \times Fz$ is double of the equal triangle SFE.

118. Cor. 3. The angular velocity round S, that is, the angular magnitude of the angle described in equal times by the velocity is inversely proportional to the square of the distance from S. For when the arches AB, EF are diminished continually, the perpendiculars Ba and Fz will ultimately coincide with arches described round S with the radii SB and SF. Now the magnitude of an angle is proportional to the length of the arch which measures it directly, and to the radius of the arch inversely. In any circle, an arch of two inches long measures twice as many degrees as an arch one inch long; and an arch one inch long contains twice as many degrees of a circle whose radius is twice as short. Therefore, ultimately, the angle ASB is to the angle ESF as Ba to Fz, and as SF to SB jointly; that is, as $Ba \times SF$ to $Fz \times SB$. But $Ba : Fz = SE : SA$ (Cor. 2); therefore $ASB : ESF = SE \times SF : SB \times SA$, = ultimately $SE^2 : SB^2$.

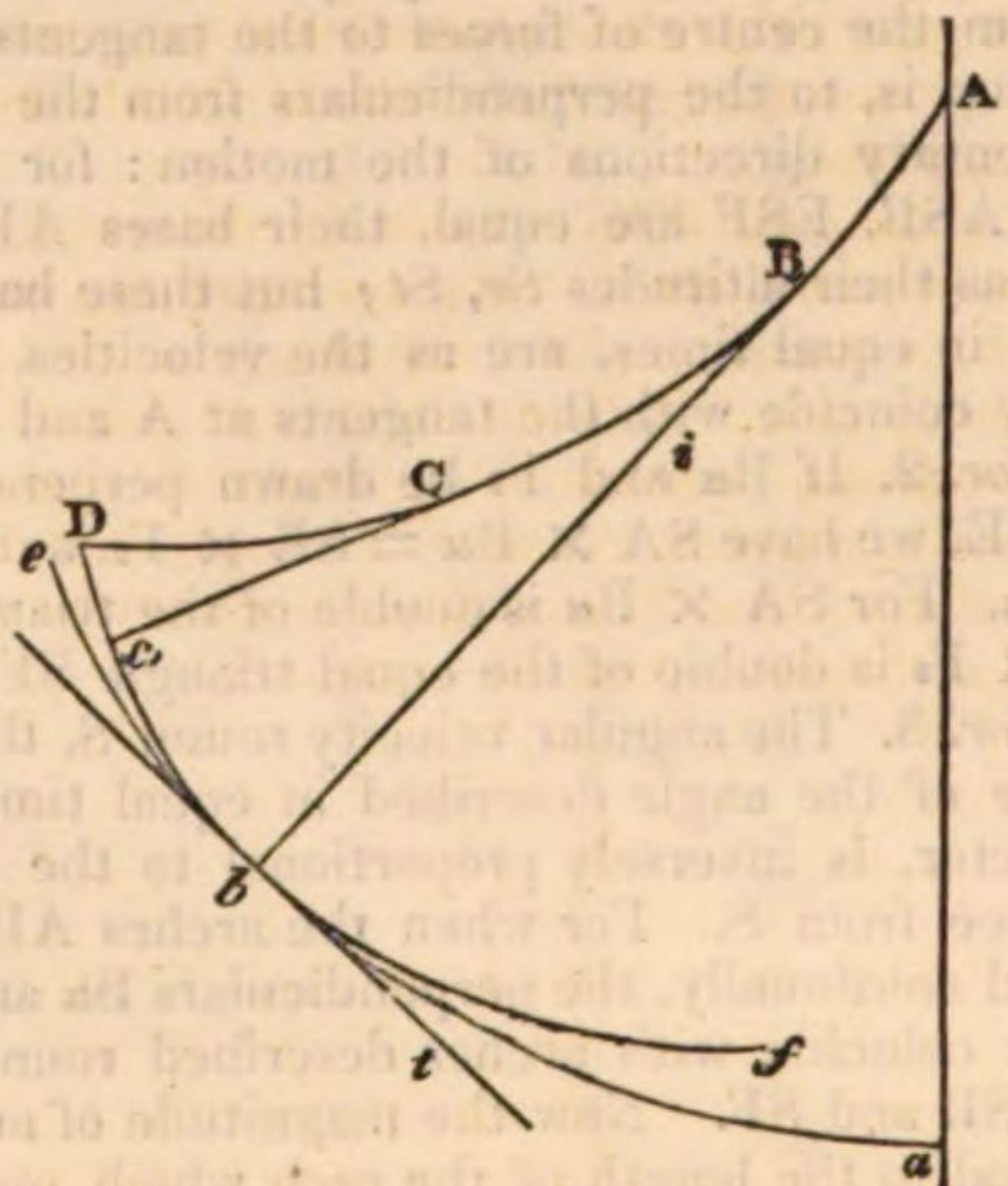
This corollary gives us an ostensible mark, in many very important cases, of the action of a deflecting force being always directed to a fixed point. We are often able to measure the angular motion when we cannot measure the real velocities.

Having thus discovered the chief circumstances which enable us to ascertain the direction of the deflecting force, we proceed to investigate the quantity of this deflective determination in the different points of a curvilinear motion. This is a more difficult task. The momentary effect of the deflecting force is a small deviation from the tangent; and this deviation is made with an accelerated motion. The law of this acceleration regulates the curvature of the path, and is to be determined by it. We may be allowed to observe by the way, that it appears clearly, from the form in which Newton has presented all his dynamical theorems, that we are indebted to these problems for the immense improvement which he has made in geometry by his invention of fluxions. The purposes he had in view suggested to his penetrating mind the means for attaining them; and the connection between dynamics and geometry is so intimate, that the same theorems are in a manner common to both. This is

Of Deflect- particularly the case in all that relates to curvature. Or ing Forces. shall we say that the geometry of Dr Barrow suggested the dynamical theorems to Newton? We have seen how the curvature of a parabola is produced by a force acting uniformly. The *momentary* action of all finite forces may be considered as uniform, and therefore the curvature will be that of some portion of some parabola; but it will be difficult to determine the precise degree without some farther help. We are best acquainted with the properties of the circle, and will have the clearest notions of the curvature of other curves by comparing them with circles.

Measure of curvature. The curvature of a circular arch of given length is so much greater as its radius is shorter, for it will contain so many more degrees in the same length; and therefore the change of direction of its extremities is so much greater. Curvatures may always be measured by the length of the arch directly, and the radius inversely.

Fig. 25.



Evolution and involu- 119. Suppose a thread made fast at one end of a material tion of curves. curve ABCD (fig. 25), and applied to it in its whole length. Taking hold of its extremity D, unfold it gradually from the curve DCBA; the extremity D will describe another curved Dcba. This geometrical operation is called the *evolution* of curves, and Dcba is called the *evolute* of DCBA, which is called the *involute* of Dcba. Perhaps this denomination has been given from the genesis of the area or surface contained by the two lines, which is folded up and unfolded somewhat like a fan. When the describing point is in *b*, the thread *bB* is undoubtedly the momentary radius of a circle *ebf*, whose centre is *B*, the point of the involute which it is just going to quit. The momentary motion of *b* is the same, whether it is describing an arch of the evolute passing through *b*, or an arch of a circle round the centre *B*. The same line *bt*, perpendicular to the thread *bB*, touches the circle *ebf* and the curve *Dba* in the point *b*. This circle *ebf* must lie within the curve *Dba* on the side of *bB* toward *a*, because on this side the momentary radius is continually increasing. For similar reasons, the circle *ebf* lies without the curve on the other side of *bB*. Therefore the circle *ebf* both touches and cuts the curve *Dba* in the point *b*. Moreover, because every portion of the curve between *b* and *D* is described with radii that are shorter than *bB*, it must be more incurvated than any portion of the circle *ebf*. For similar reasons, every portion of the curve between *b* and *a* must be less incurvated than this circle; therefore the circle has that precise degree of curvature that belongs to the curve in the point *b*; it is therefore called the *equicurve circle*, or the *circle of curvature*, and *B* is called the centre, and *Bb* the *radius of curvature*. It is easy to perceive that no circle can be

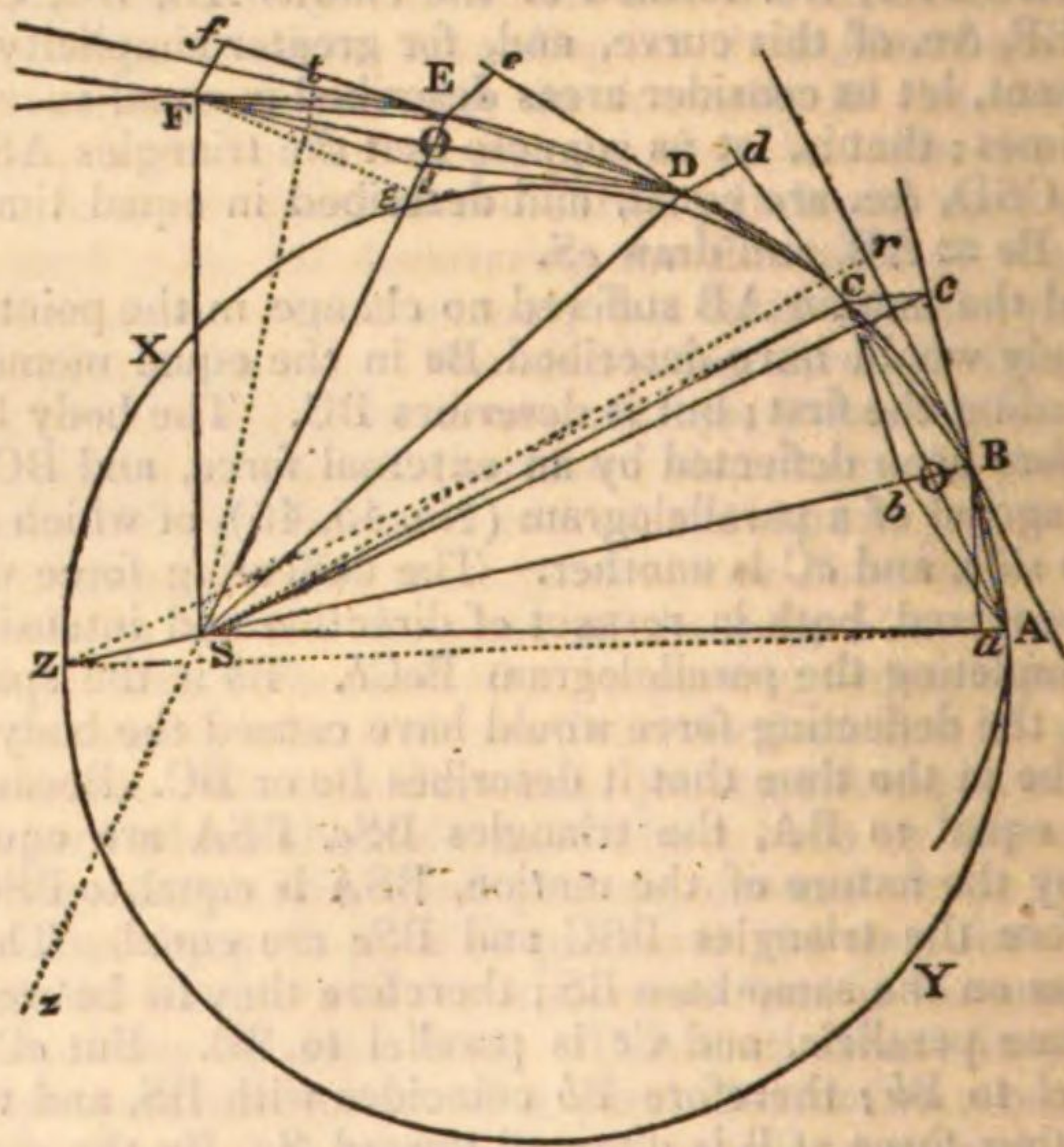
described which shall touch the curve in *b*, and come between it and the circle *ebf*; for its centre must be in some point *i* of the radius *bB*. If *ib* be less than *Bb*, it must fall within the curve on both sides of *b*, and if *ib* is greater than *Bb*, the circle must fall without the curve on both sides of *Bb*. The circle *ebf* lies closer to the curve, has closer contact with it than any other, and has therefore got the whimsical name of *osculating circle*; and this sort of contact was called *osculation*.

This view of the genesis of curve lines is of particular use in dynamical discussions. It exhibits to the eye the perfect sameness of the momentary motion, and therefore of the momentary deflection, in the curve and in the equicurve circle, and leaves the mind without a doubt but that the forces which produce the one will produce the other. A great variety of curves may be described in this way. If perpendiculars be drawn to the curve *Dba* in every point, they will intersect each other, each its immediate neighbour, in the circumference of the curve *DBA*; and geometry teaches us how to find the curve *DBA* which shall produce the curve *Dba* by evolution. (See FLUXIONS.)

It is a matter worthy of remark, that the path of a body that is deflected from rectilinear motion by a *finite* force, varying according to any law whatever, may always be described by evolution. This includes almost every case of the action of deflecting forces; none being excepted but when, by the opposite action of different forces, the body is in equilibrio in one single point of its path.

Our task is now brought within a very narrow compass, namely, to measure the deflection in the arch of a circle.

Fig. 26.



Had the motion represented in fig. 26 been polygonal, it is plain that the deflecting force in the point *B* is to that in the point *E* as the diagonal *Bb* of the parallelogram *ABCb* to the diagonal *Ei* of the parallelogram *DEFi*; therefore let *ABCZY* be a circle passing through the points *A*, *B*, and *C*, and let the radius vector *BS* cut the circumference in *Z*; draw *AZ*, *CZ*, and the diagonal *AC*, which necessarily bisects and is bisected by the diagonal *Bb*. The triangles *bBC* and *CBZ* are similar; for the angle *CbB* is equal to the alternate angle *ABb* or *ABZ*, which is equal to the angle *ACZ*, standing on the same chord *AZ*. And the angle *CBb*, or *CBZ*, is equal to *CAZ*, standing on the same chord *CZ*; therefore the remaining angle *bCB* is equal to the remaining angle

Of Deflect- ing Forces. AZC; therefore ZA is to AC as BC to Bb, and Bb = $\frac{AC \times BC}{AZ}$. In like manner Ei = $\frac{DF \times EF}{Dz}$.

Measure of deflecting forces. Now let the points A and C continually approach, and ultimately coalesce with B; it is evident that the circle ABCZY is ultimately the equicurve or coinciding circle at the point B, and that AS ultimately coalesces with and is equal to BS, and that AC $\times$ BC is ultimately $2BC^2$; therefore ultimately Bb : Ei = $\frac{2BC^2}{BZ} : \frac{2EF^2}{Ez}$, or = $\frac{BC^2}{\frac{1}{2}BZ} : \frac{EF^2}{\frac{1}{2}Ez}$.

Now BC and EF being described in equal times, are as the velocities: Bb and Ei are the measures of the velocities which the deflective forces at B and E would generate in the time that the body describes BC or EF, and are therefore the measures of those forces. They are as the squares of the velocities directly, and inversely as those chords of the equicurve circles which have the directions of the deflection.

Observe that Bb or Ei is the third proportional to half of the chord and the arch described; for Bb : BC = BC : $\frac{BZ}{2}$.

It is evident, that as the arches AB, BC, continually diminish, AC is ultimately parallel to the tangent Br, and BO is equal to the actual deflection from the tangent.

The triangles BOC and AOZ are similar, and BO = $\frac{OC^2}{OZ}$,

or ultimately = $\frac{BC^2}{BZ}$. We may measure the forces by the

actual deflections, because they are the halves of the measures of the generated velocities; and we may say that

Measure of 120. The actual momentary deflection from the tangent is a deflection. third proportional to the deflective chord of the equicurve circle and the arch described during the moment.

Caution. Either of these measures may be taken, but we must take care not to confound them. The first is the most proper, because the change produced on the body (which is the immediate effect and measure of the force) is the determination left inherent in it to move with a certain velocity. This is the measure also which we obtain by means of the differential or fluxionary calculus; but the other measure must be obtained when our immediate object is to mark the actual path of the body. The steps of this demonstration, which is Newton's, naturally terminate in the equicurve circle, and give at once the immediate measure of the deflecting force. At the same time the reader must perceive that this measure does not depend on the force being always directed to one centre; it is enough that the two sides of the polygon, in immediate succession, are described in equal times. This is necessary in order that ABCb may be a parallelogram, and that the diagonals AC and Bb may mutually bisect each other.

Thus have we obtained a measure of deflecting force, and, in the most important cases, a method of discovering its direction. It only remains to point out the relation between the intensity of the force, the curvature of the path, and the velocity of the motion. These three circumstances have a necessary connection; for we see that the intensity is expressed by certain values of the other

two in the formula $f \div \frac{\text{Arch}^2}{\frac{1}{2}\text{Chord}}$, or $f = \frac{2BC^2}{BZ}$. The de-

flective velocity Bb is acquired in the time that the body describes BC; therefore the deflective velocity is to the velocity in the curve as Bb to BC. The velocity Bb is acquired by an accelerated motion along BO; for while, by progres-

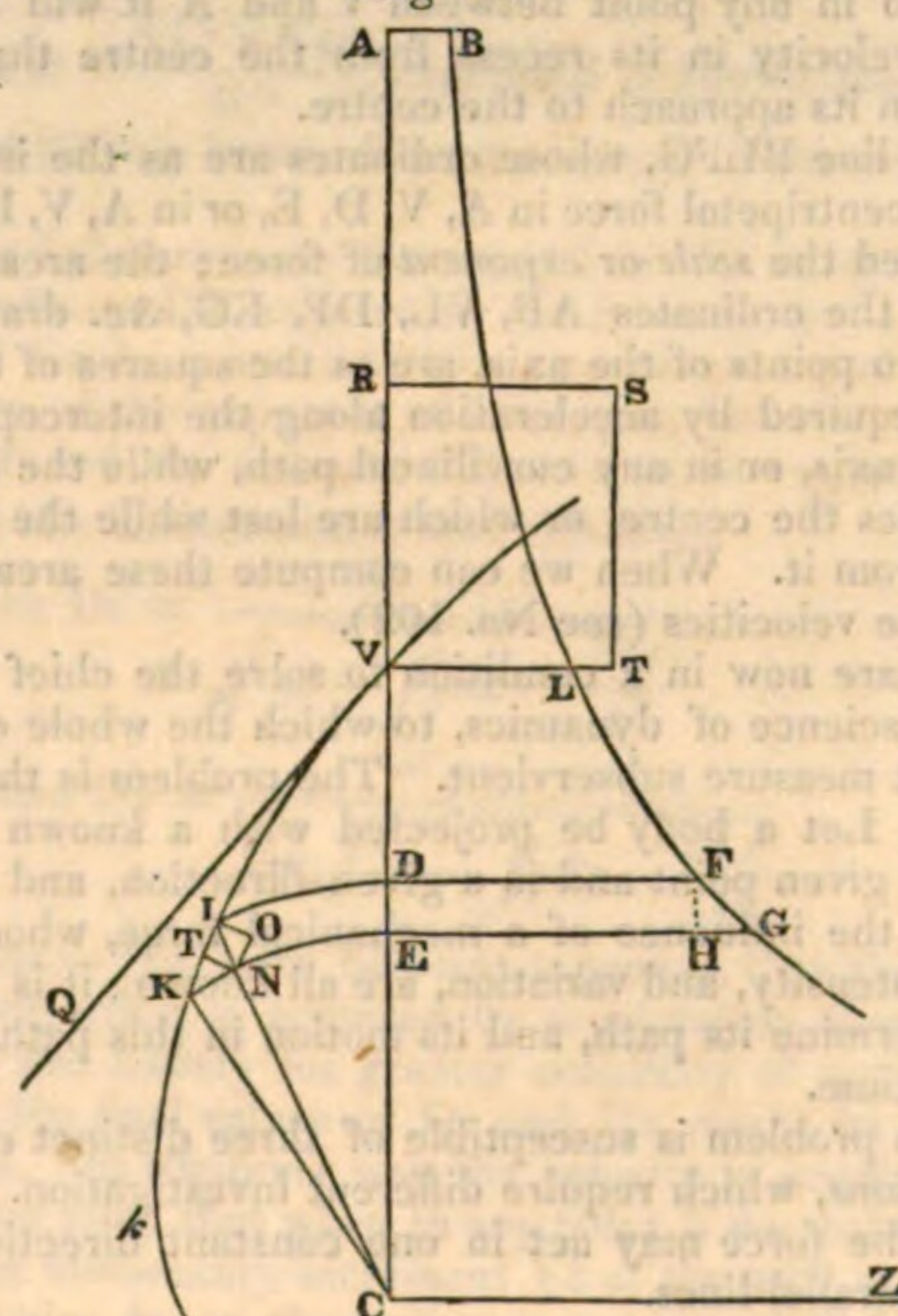
sive motion, the body describes BC, it deflects from the tan- Of Deflect- gent through a space equal to the half of Bb, because the ing Forces. momentary action of the deflecting force may be considered as uniform. The progressive velocity BC may be generated by the same force uniformly acting through a space greater than BC; call this space x. The spaces along which a body must be uniformly impelled in order to acquire different velocities are as the squares of those velocities; therefore Bb² : BC² = Bo : x; but Bb : BC = BC : $\frac{1}{2}BZ$; therefore Bb² : BC² = Bb : $\frac{1}{2}BZ$, and Bb : $\frac{1}{2}BZ$ = Bo : x, and Bb : Bo = $\frac{1}{2}BZ : x$; but Bo is $\frac{1}{2}$ of Bb, therefore x is $\frac{1}{4}$ of BZ; that is,

121. The velocity in any point of a curvilinear path is that which the deflecting forces in that point would generate in the body by impelling it uniformly along one fourth part of the deflective chord of the equicurve circle. If the velocity increase, the chord of the equicurve circle must increase; that is, the path becomes less incurvated. If the force be increased, the curvature will also increase, for the chord of curvature will be less.

There is another general observation to be made on the velocity of a curvilinear motion, which greatly assists us in our investigation.

122. If a body describes a curve by the action of a force Compari- always directed to a fixed point, and varying according to son of orbi- any proportion whatever of the distances from that point, and tal motion if another body, acted on by the same centripetal force, move with direct toward the centre in a straight line, and if in any one case of approach to equal distances from the centre of force the two bodies have equal velocities, they will have equal velocities in every other case of equal distances from the centre.

Fig. 27.



Let one body be impelled from A (fig. 27) toward C along the straight line AVDEC, and let another be deflected along the curve line VIKk. About the centre C describe concentric arches ID, KE, very near to each other, and cutting the curve in I and K, and the line AC in D and E; draw IC, cutting KE in N, and draw NT perpendicular to the arch IK of the curve, and complete the parallelogram ITNO. Let the bodies be supposed to have equal velocities at I and at D.

Then, because the centripetal forces are supposed to be the same for both bodies when they are at equal distances, the accelerating forces at D and I may be represent-

Of Deflect- ed by the equal lines DE and IN; but the force IN is not ing Forces. wholly employed in accelerating the body along the arch IK, but, acting transversely, it is partly employed in incurvating the path. It is equivalent to the two forces IO and IT, of which only IT accelerates the body. Now IKN is a right-angled triangle, as is also the triangle INT; and they are similar; therefore $IN : IT = IK : IN$, or $DE : IT = IK : DE$; that is, the force which accelerates the body along DE is to the force which accelerates the body along IK as the space IK is to the space DE; therefore (No. 86) the increment of the square of the velocity acquired along DE is equal to the increment of the square of the velocity acquired along IK. But the velocities at D and I were equal, and consequently their squares were equal; and these having received equal increments, therefore the squares of the velocities at E and K are equal, and the velocities themselves are equal. And since this is the case in all the corresponding points of the line AC and the curve VIK, the velocities at all equal distances from C will be equal.

It is evident that the conclusion will be the same, if the bodies, instead of being accelerated by approaching the centre in the straight line AC, and in the curve VIK, are moving in the opposite directions from E to A, or from I to V, and are therefore retarded by the centripetal force.

Retarded curvilinear motion always accompanied by recess from the centre. 123. *Cor.* Hence it follows, that if a body be projected from any point, such as V, of the curve, in a line tending straight from the centre, with the velocity which it had in that point of the curve, it would go to a distance VA, such, that if it were impelled along AV by the centripetal force, it would acquire its former velocity in the point V; also in any point between V and A it will have the same velocity in its recess from the centre that it has there in its approach to the centre.

The line BLFG, whose ordinates are as the intensities of the centripetal force in A, V, D, E, or in A, V, I, K, may be called the *scale* or *exponent* of force; the areas bounded by the ordinates AB, VL, DF, EG, &c. drawn from any two points of the axis, are as the squares of the velocity acquired by acceleration along the intercepted part of the axis, or in any curvilinear path, while the body approaches the centre, or which are lost while the body retires from it. When we can compute these areas we obtain the velocities (see No. 102).

We are now in a condition to solve the chief problem in the science of dynamics, to which the whole of it is in a great measure subservient. The problem is this:

Inverse problem of centripetal forces. 124. Let a body be projected with a known velocity from a given point and in a given direction, and let it be under the influence of a mechanical force, whose direction, intensity, and variation, are all known; it is required to determine its path, and its motion in this path, for any given time.

This problem is susceptible of three distinct classes of conditions, which require different investigation.

1. The force may act in one constant direction; that is, in parallel lines.

2. The force may be always directed to a fixed point.

3. It may be directed to a point which is continually changing its place.

1. When the force acts in parallel lines, the problem is solved by compounding the rectilinear accelerated motion which the force would produce in its own direction with the uniform motion which the projection alone would have produced. The motion must be curvilinear when the accelerating force is transverse, in any degree whatever, to the projectile motion; and the curvilinear path must be concave on that side to which the deflecting force tends, for the force is supposed to act incessantly. The place of

the body will be had for any time, by finding where the body would have been at the end of that time by each force acting alone, and by completing the parallelogram. Thus, suppose a body projected along AB (fig. 23), while it is continually acted on by a force whose direction is AD. Let D and B be the places where the body would be at the end of a given time. Then the body will, at the end of that time, be in F, the opposite angle of the parallelogram ABFD. But it has not described the diagonal AF, because its motion has been curvilinear, as we shall find by determining its place at other instants of this time.

The velocity in any point F is found by first determining the velocity at D, and making Dd to DF as the velocity at D to the velocity at B (that is, the velocity of projection, because the motion along AB is uniform). Then draw dF. Then AB is to dF as the constant velocity of projection to the velocity at F. We have seen already (No. 112-119) that dF is a tangent to the curve in F. Hence we may determine the velocity at F in another way. Having determined the form of the path in the way already described, by finding its different points, draw the tangent Fd, cutting the line DA in d. Then the velocity at A is to that at F as AB to dF. Hence also we see that the velocities in every point of the curve are proportional to the portion of the tangents at those points which are intercepted between any two lines parallel to AD.

Either of these methods for ascertaining the velocity, in this case of parallel deflections, will in general be easier than the general method in No. 121, by the equi-curve circle.

It was thus that Galileo discovered the parabolic motion of heavy bodies.

2. We must consider the motions of bodies affected by centripetal or centrifugal forces, always tending to one fixed point. This is the celebrated *inverse problem of centripetal forces*, and is the forty-second proposition of the first book of Newton's *Principia*. We shall give the solution after the manner of its illustrious author, because it is elementary in the purest sense of the word, keeping in view the two leading circumstances, and these only, namely, the motion of approach and recess from the centre, and the motion of revolution. By this judicious process, it becomes a pattern by which more refined, and, in some respects, better solutions should be modelled. At the same time we shall supply some steps of the investigation which his elegant conciseness has made him omit.

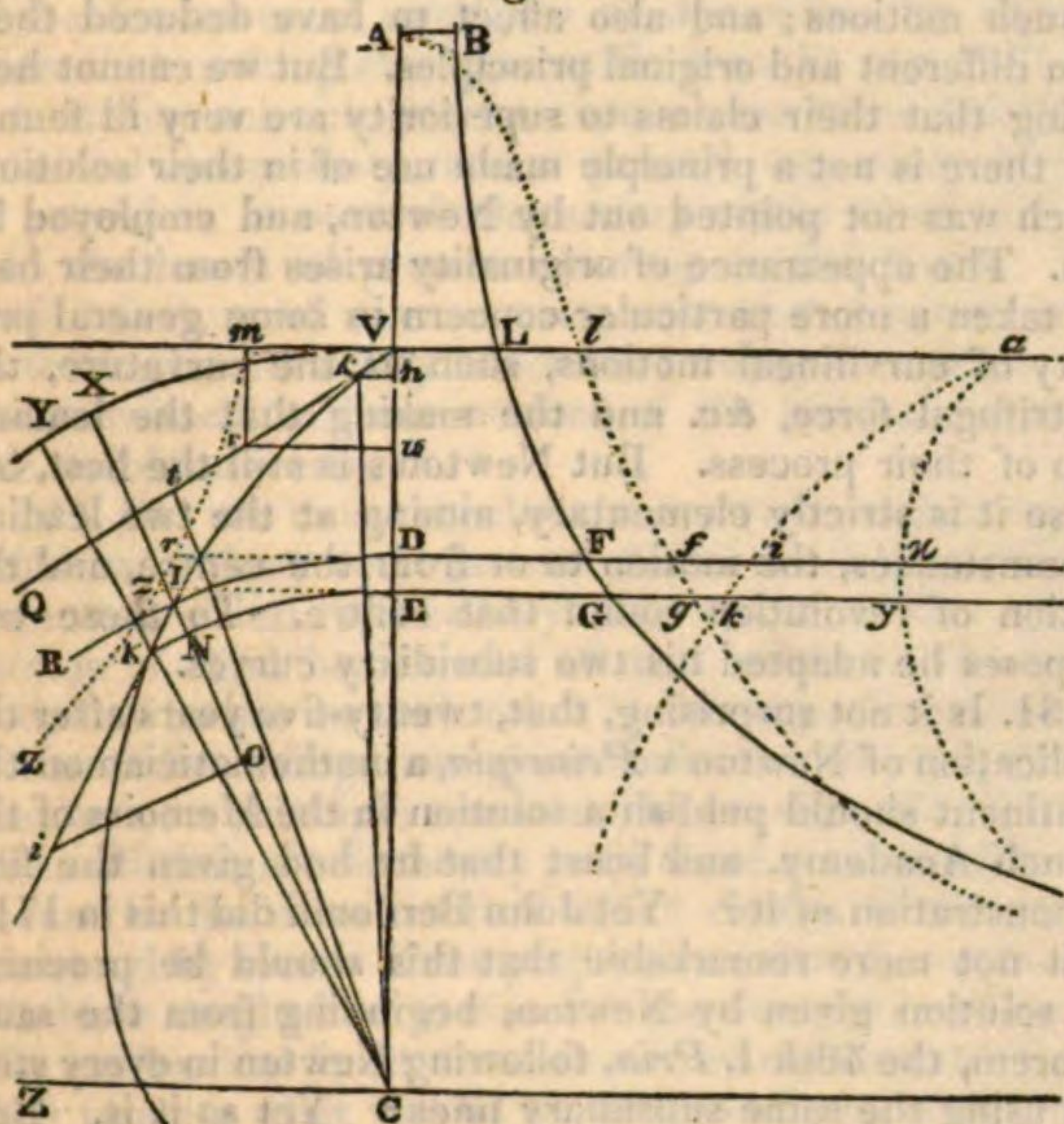
125. Let a body which tends to C (fig. 28) with a force proportional to the ordinates of the exponent BLFG, having the axis CA, be projected from V in the direction VQ, with the velocity which the centripetal force would generate in it by accelerating it along AV. It is required to determine the path or orbit VIKI of the body, and its place I in this orbit, at the end of the assigned time T.

Suppose the thing done, and that I is the place of the body. About the centre C, with the distances CV and CI, describe the circles YV and ID. Draw CIX to the circumference, and draw the ordinate DF of the exponent of forces, producing it toward x, and produce the ordinate VL toward a. Let Vt be the distance to which the body would go along the tangent VQ in the time T, and join tC. Let this be supposed done for every point of the curve. Let aik and axy be two curves so related to the curve VIK, that the ordinate DF cuts off an area VaiD equal to the orbital sector VCI, and an area VaxD equal to the circular sector VCX.

Then, because the velocity of projection is given, the

Of Deflect- ing Forces. distance Vt is known, and the area of the triangle VCt . But this is equal to the area VCI , by the laws of central forces. (No. 115.) Therefore the area $VaiD$ is given. Also, because the area VCI increases in the proportion of the time, the area $VaiD$ increases at the same rate.

Fig 28.



Therefore, having these subsidiary curves aik , axy , the problem is solved as follows:

Draw an ordinate Di , cutting off an area $VaiD$ proportional to the time, and describe a circle DIR . Then draw a line CX , cutting off a sector VCX , equal to the area $VaxD$ cut off by the ordinate Dix . This line will cut the circle DR in the point I , which is the point of the orbit that was demanded.

But the chief difficulty of the problem consists in the description of the two subsidiary curves aik and axy , into which the lines VIK and VXY are transformed. We attain this construction by resolving the motion in the arch of the orbit into two motions, one of which is in the direction of the transverse force, or of the radius vector, and the other is in the direction of revolution, or perpendicular to the radius.

Let Vk and IK be two very small arches described in equal moments, and therefore ultimately in the ratio of the velocities in V and I (No. 73). Describe the circle KE , cutting IC in N . Draw KC and kC , and kn perpendicular to VC .

The element ICK of the orbit is $= \frac{IC \times KN}{2}$, or to $\frac{1}{2} IC \times KN$. This is equal to the element $DikE$ of the area $VaiD$, or to $Di \times DE$, or to $Di \times IN$. Therefore $IN : KN = \frac{1}{2} IC : Di$, or $2IN : KN = IC : Di$, and $Di = \frac{IC \times KN}{2IN}$.

Now let $Alfgh$ be the exponent of the velocities, that is (No. 86), let Vl^2 be to Df^2 as $ABLV$ to $ABFD$, or $Vl : Df = \sqrt{ABLV} : \sqrt{ABFD}$. Make Vv and Ii in the tangents respectively equal to Vl and Df . Draw vu and iO perpendicular to VC and IC , and vm perpendicular to LV produced. Let mz be an equilateral hyperbola, having VC , ZC , for its asymptotes, and cutting FD produced in r . Then the ordinates Vm , Dr , are inversely proportional to CV , CD , or $Vm : Dr = CD : CV = CI : CV$. But because the momentary sectors VCK and ICK are equal, $kn : KN = CI : CV$. Therefore,

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$$Vm : Dr = kn : KN;$$

$$\text{but } Vv : Vm = Vk : kn,$$

$$\text{and } Ii \text{ (or } Df) : Vv = IK : Vk,$$

$$\text{therefore } Ii : Dr = IK : KN;$$

$$\text{but } Ii : iO = IK : KN, \text{ by sim. triang.}$$

$$\text{therefore } Dr = iO, \text{ and } iO : Vm = VC : CI.$$

$$\text{Also, by similarity of triangles, } IO : iO = IN : KN, \text{ and } 2IO : iO = 2IN : KN.$$

Now it was shown, that in order that the space $DikE$ may be equal to the space ICK , we must have

$$2IN : KN = IC : Di,$$

$$\text{or } 2IO : iO = IC : Di;$$

$$\text{but } iO : Vm = VC : IC,$$

$$\text{therefore } 2IO : Vm = VC : Di,$$

$$\text{and } Di = \frac{VC \times Vm}{2IO}.$$

Having obtained Di , we easily get Dx ; for the ultimate ratio of ICK to XCY is that of IC^2 to VC^2 . Therefore make

$$IC^2 : VC^2 = Di : Dx.$$

Thus are the points of the two subsidiary curves aik , axy , determined.

The rectangle $VC \times Vm$ is a constant magnitude, and is given because VC is given, and Vm is the given velocity Vl , diminished in the ratio of radius to the sine of the given angle CVQ .

But the line $2IO$ is of variable magnitude; but it is also given by means of known quantities. IO^2 is $= Ix^2 - iO^2$, $= Df^2 - Dr^2$, and $IO = \sqrt{Df^2 - Dr^2}$. Moreover, $Df^2 = ABFD$, and $Dr^2 = \frac{VC^2 \times Vm^2}{IC^2}$. Therefore $2IO =$

$$2 \sqrt{ABFD - \frac{VC^2 \times Vm^2}{IC^2}}, \text{ expressed in known quantities,}$$

because $ABFD$ is known from the nature of the centripetal force.

Let the indeterminate distance CI or CD be $= x$, and let the ordinate DF , expressing the force, be y . Let VC be a , and Vm be c , and let ab be a rectangle equal to the whole area of the exponent of force lying between the ordinate AB and the ordinate CZ , so that $ba - \int ydx$ may represent the indeterminate area $ABFD$.

$$\text{We have } Di = \frac{ac}{2 \sqrt{ab - \int ydx - \frac{a^2 c^2}{x^2}}}$$

$$\text{and } Dx = \frac{a^3 c}{2x^2 \sqrt{ab - \int ydx - \frac{a^2 c^2}{x^2}}}.$$

REMARK.—We have hitherto supposed that the velocity of projection is acquired by acceleration along AV . But this was merely for greater simplicity of argument, and that the final values of Di and Dx might be easier conceived. In whatever way the velocity is acquired, it will still be true, that when in any point V we make Vl to Vm as the momentary increment Vk of the arch is to the perpendicular kn on the radius vector, we shall have in every other point, such as I , the line Df to the line Dr as the increment IK of the arch to KN . And in the final equation Df will still be expressed by $\sqrt{ab - \int ydx}$.

126. Cor. 1. The angle which the path of the projectile makes with the radius vector is determined by this solution; for Ii is to iO as radius to the sine of this angle; which sine is therefore $= \frac{ac}{x \sqrt{ab - \int ydx}}$.

127. Cor. 2. When the magnitude $\frac{ac}{x}$ is equal to Apsides determined, $\sqrt{ab - \int ydx}$, the path is perpendicular to the radius vector;

Of Deflect- ing Forces. and curva- ture. tor, and the body is at one of the apsides of its orbit, and begins to recede from the centre after having approached to it, or begins to approach after having receded.

128. Cor. 3. The curvature of the orbit VIK is also determined in every point; for the curvature of any line is inversely as the radius of the equicurve circle, and this is to the chord which passes through C as radius to the sine of the angle CII. Because the velocity in any point I is $= \sqrt{ABFD}$, and is equal to what the centripetal force at I would produce, by impelling the body along one fourth of the deflective chord of the equicurve circle, we have this chord $= 4 \frac{ABFD}{DF}$. Or we obtain it by taking a third

proportional to the momentary deflection and the momentary arch of the curve, or by other processes of the higher geometry, all proceeding on the quantities furnished in this investigation.

Newton the inven- tor.

129. Such is the solution of this celebrated problem given by Sir Isaac Newton, who may justly be called the inventor of the science of which it is the chief result, as well as of the geometry by help of which it is prosecuted. For we cannot give this glory to Galileo; for his simple problem of the motion of bodies affected by uniform and parallel gravity, however just and elegant his solution may be, was peculiar; and the same must be said of Mr Huygens's doctrine of centrifugal forces. Besides, these theorems had been investigated by Newton several years before, *suâ mathesi facem preferente*, as corollaries which he could not pass unnoticed, from his general method. This is proved by letters from Huygens. Newton's investigation is extremely but elegantly concise, and is one of the best exertions of his sagacious mind.

History of this problem.

130. Whether we consider this problem as a piece of mere mathematical speculation, or attend to its consequences, which include the whole of the celestial motions in all their extent and complication, we must allow it to be highly interesting, and likely to have engaged much attention in the period of ardent inquiry which closed the last century. Accordingly, it was no sooner known, by the publication of the *Mathematical Principles of Natural Philosophy* in 1686, than it occupied the talents of the most eminent mathematicians; and many solutions were published, some of which differ considerably from Newton's, and some are more expeditious, and better fitted for computation. Of these, the most remarkable for originality and ingenuity are those of De Moivre, Hermann, Keill, and Stewart. The last differs most from the methods pursued by others. M'Laurin's propositions on this subject, and in that part of his fluxions which treats of curvature, are highly valuable, classing the chief affections of curvilinear motions geometrically, as they are suggested by the fluxionary method; and then showing, in a very instructive manner, the connection between these mathematical affections of motion and the powers of nature which produce them. This part of his excellent work is a fine example of the real nature of all inquiries in dynamics, showing that it differs from geometry little more than in the language, in which the word *force* is substituted for *acceleration*, *retardation*, or *deflection*. We recommend the careful perusal of these propositions to all who wish to have clear conceptions of the subject. Dr John Keill and Dr Horsley (bishop of Rochester) have given particular treatises on the motions of bodies deflected by centripetal forces inversely proportional to the cubes of the distances; induced by the singular motions which result from this law of action, and the multitude of beautiful propositions which they suggest to the mathematician. Newton, indeed, first perceived both of these peculiarities, and has begun this branch of the general problem. He first de-

monstrated the description of the logarithmic and hyperbolic spirals, and indicated a variety of curious recurring elliptical spirals, which would be described by means of this force, showing that they are all susceptible of accurate quadrature. Several of those authors affect to consider their solutions as more perfect than Newton's, and as more immediately indicating the remarkable properties of such motions; and also affect to have deduced them from different and original principles. But we cannot help saying that their claims to superiority are very ill founded; there is not a principle made use of in their solutions which was not pointed out by Newton, and employed by him. The appearance of originality arises from their having taken a more particular concern in some general property of curvilinear motions, such as the curvature, the centrifugal force, &c. and the making that the leading step of their process. But Newton's is still the best, because it is strictly elementary, aiming at the two leading circumstances, the motion to or from the centre, and the motion of revolution round that centre. To these two purposes he adapted his two subsidiary curves.

131. Is it not surprising, that, twenty-five years after the publication of Newton's *Principia*, a mathematician on the Continent should publish a solution in the Memoirs of the French Academy, and boast that he had given the first demonstration of it? Yet John Bernoulli did this in 1710. Is it not more remarkable that this should be precisely the solution given by Newton, beginning from the same theorem, the 40th I. *Prin.* following Newton in every step, and using the same subsidiary lines? Yet so it is. Bernoulli actually reduces the whole to two functions, namely,

$$\sqrt{ab - \int \phi dx - \frac{a^2 c^2}{x^2}} \quad \text{and} \quad \sqrt{abx^4 - x^4 \int \phi dx - a^2 c^2 x^2};$$

which last is plainly the same with Newton's

$$\frac{Q \times CX^2}{A^2 \sqrt{ABFD - Z}};$$

because Newton's $\frac{Q}{A}$ is the same with $\frac{ac}{x}$, and Newton's

$A^2 \sqrt{ABFD - Z^2}$ is the same with

$$x^2 \sqrt{ab - \int \phi dx - \frac{a^2 c^2}{x^2}},$$

which Bernoulli has changed into

$$\sqrt{abx^4 - x^4 \int \phi dx - a^2 c^2 x^2}.$$

Bernoulli's chief boast in this dissertation is, that *now* philosophers may be assured that the planets will always describe conic sections; a truth of which they had not as yet received any proof; because, says he, Newton's argument for it in the corollary of the 13th proposition is inconclusive, and because he had not been able to accommodate his demonstration of the 41st and 42d propositions to the particular case of the planetary gravitation. Newton's demonstration in the corollary of the 13th proposition is just founded on the principle on which the very demonstration of the 42d, adopted by Bernoulli, proceeds, and without which that demonstration is of no force; namely, that a body, in given circumstances of situation, velocity, direction, and centripetal force, can describe no other figure than what it really describes. Newton did not accommodate the demonstration of the 42d proposition to the planetary motions, because he had already demonstrated the nature of their orbits; but mentions the case of a force proportional to the reciprocal of the cubes of their distance, not as a deduction from the 42d, but because it *was not* a deduction from it, and admitted a very singular and beautiful investigation by methods totally and essentially different.

Of Deflect- ing Forces.

Singular boast of John Bernoulli.

Conclusion. 132. It cannot be expected that, in the narrow limits prescribed to a work like ours, we can proceed to consider the various departments of this celebrated problem. We are only giving the outlines of the general doctrines of dynamics; and we have bestowed more time on those which are purely elementary than some readers may think they deserve. We were anxious to give just conceptions of the fundamental principles of dynamics; because we know that nothing else can entitle it to the name of a demonstrative science, and because we see much indistinctness and uncertainty, and a general vagueness or want of precision, in several elementary works which are put into the hands of persons entering on the study. This leads to errors of more consequence than a person is apt to think; because they affect our leading thoughts of mechanism itself, and our notions of the intimate nature of the visible universe.

Universal re-action is a law of the material world. 133. But we must conclude the article with this great problem. Many very general doctrines of dynamics remain untouched; all, namely, that relate to the rotative motion of rigid bodies, and all that relate to the mutual action of bodies on each other in the way of impulse.

Notwithstanding these great omissions, we must observe that no new principle remains to be considered. We have given all that are necessary; and there is no question that occurs in the cases omitted which cannot be completely answered by means of the propositions already established. We have taught how to discover the existence and agency of a mechanical force, to measure and characterize it, and then to state what will be its various effects, according to the circumstances of the case.

134. Proceeding by these principles, men have discovered an universal fact, that every *action* of one body on another is accompanied by an equal *re-action* of that other on the first in the opposite direction; that is, to express it in the language of dynamics, "all the phenomena which make us infer that the body A possesses a force by which it changes the motion of the body B, show, at the same time, that B possesses a force by which it makes an equal and opposite alteration in the motion of A." This, however, is not a doctrine of abstract dynamics; it does not flow from our idea of force; therefore it was not included in our list of the *laws of motion*. It is a part of the mechanical history of nature, just as the law of universal gravitation is; and it might be called the law of *universal re-action*. Sir Isaac Newton has, in our humble apprehension, deviated from his accustomed logical accuracy, when he admits, as a third *axiom* or law of motion, that re-action is always equal and contrary to action. It is a physical law, in as far as it is *observed* to obtain through the whole extent of the solar system. But Newton himself did not, in the subsequent part of his noble work, treat it as a logical axiom; that is, as a law of human thought with respect to motion; for he labours with much solicitude, and with equal sagacity, to prove, by *fact and observation*, that it really obtains through the whole extent of the solar system; and it is in this discovery that his chief claim to unequalled penetration and discernment appears.

Impulsion explained by it, 135. Availing ourselves of this fact, we, with very little trouble, state all the laws of impulsion. The body A, for example, moving to the westward at the rate of eight feet per minute, overtakes the double body B, moving at the rate of four feet per minute. What must be the consequence of their impenetrability, and of the equality and contrariety of action and re-action? Their motions must be such that both sustain equal and opposite changes. They must give, in some way or other, *this* indication of possessing equal and opposite forces. This will be the case if, when the changes are completed, A and B move on in contact at the rate of four feet per minute; for here

A has produced in each half of B a change of motion two, and therefore a totality of change equal to four. This is the effect, the mark, the measure of the *impulsive* force of A; for it is the whole *impulsion*. B has produced in A a change of motion four, equal to the former, and in the opposite direction. This is the effect, mark, and measure of the *repulsive* force of A; for it is the whole *repulsion*. And this is all that we observe in the collision of two lumps of clay; and the observation is one of the facts on which the reality of the physical law of equal action and re-action is founded; and we can make no further inference from *this* fact.

But the event might have been very different. A and B may be two magnets floating on corks on water, with their north poles fronting each other. We know, by other means, that they really possess forces by which they equally repel each other. The dynamical principles already established tell us also what must happen in this case. That both conditions of equal re-action and sensible repulsion may be fulfilled, A must come to rest, and B must move forward at the rate of four feet per minute. The same thing must happen in the meeting of perfectly elastic bodies, such as billiard balls. If elasticities are known to be imperfect in any degree, our dynamical principles will still state the effect of their collision in conformity to the law of equal reaction.

136. In like manner, all the motions of rotation are explained or predicted by means of the same principles of dynamics applied to the force of cohesion. This is considered as a moving force, because, when the attraction of a magnet acts on a bit of iron attached to one end of a long lath floating on water, the whole lath is moved, although the magnet does not act on it at all; some other force acts on it; it is its cohesion, which is therefore a moving force, and the subject of dynamical discussion.

137. And thus it appears that these subjects do not come necessarily, nor perhaps with scientific propriety, under the category of dynamics, but are parts of the mechanical history of nature. Yet, did a work like ours give room in this place, the study of mechanical nature might be considerably improved, by giving a system of such *general* doctrines as involve no other notions but those of force and its measures, and the hypothesis of equal re-action. Some very general, nay universal, consequences of this combination might be established, which would greatly assist the mechanician in the solution of difficult and complicated problems. Such is the proposition, that *the mutual actions of bodies depend on their relative motions only, and require no knowledge of their real motions*. This principle simplifies in a wonderful manner the most difficult and the most frequent cases of action which nature presents to our view; but at the same time gives a severe blow to human vanity, by forcing us to acknowledge that we know nothing of the real motion of any thing in the universe, and never shall know any thing of it, till our intellectual constitution, or our opportunities of observation, are completely changed.

138. M. d'Alembert had made this principle still more serviceable for extricating ourselves from the immense complication of actions that occurs in all the spontaneous phenomena of nature, by presenting it to us in a different form, which more distinctly expresses what may be called the *elements* of the actions of bodies on each other. His proposition is as follows (see his *Dynamique*, page 73):

"In whatever manner a number of bodies change their motions, if we suppose that the motion which each body would have in the following moment, if it were perfectly free, is decomposed into two others, one of which is the motion which it really takes in consequence of their mutual actions, the other will be such, that if each body were

D'Alembert's general principle of dynamics.

Dynamometer.

impressed by this force alone (that is, by the force which would produce this motion), the whole system of bodies would be in equilibrio."

This is almost self-evident; for if these second constituent forces be not such as would put the system in equilibrio, the other constituent motions could not be those which the bodies really take by the mutual action, but would be changed by the first.

For example, let there be three bodies P, Q, R, and let the forces A, B, C, act on them, such as would give them the velocities p, q, r , in any directions whatever, producing the momenta, or quantities of motion, $P \times p, Q \times q, R \times r$, which we may call A, B, C, because they are the proper measures of the moving force. Let us moreover suppose, that, by striking each other, or by being any how connected with each other, they cannot take these motions, A, B, and C, but really take the motions a, b , and c . It is plain that we may conceive the motion A impressed on the body P, to be composed of the motion a , which it really takes, and of another motion α . In like manner, B may be resolved into b , which it takes, and another β ; and C into c and γ . The motions will be the same, whether we act on P with the force A, or with the two forces a and α ; whether we act on Q with the force B, or with b and β ; and on R with the force C, or with c and γ . Now, by the supposition, the bodies actually take the motions a, b , and c ; therefore the motions α, β , and γ , must be such as will not derange the motions a, b , and c ; that is to say, that if the bodies had only the motions a, b , and c , impressed on them, they would destroy each other, and the system would remain at rest.

M. d'Alembert has applied this proposition with great address and success to the very difficult questions that oc-

cur in the motions and actions of fluids, and many other most difficult problems, such as the precession of the equinoxes, &c. The cause of its utility is, that in most cases it is not difficult to find what forces will put a system in equilibrio; and, combining these with the known extraneous forces whose effects we are interested to discover, we obtain the motions which really follow the mutual action of the bodies.

This is not, properly speaking, a principle; it is a form in which a general fact may be conceived. In the same way the celebrated mathematician De la Grange observed, that a system of bodies, acting on each other in any way, is in equilibrio, if there be impressed on its parts forces in the inverse proportion of the velocities which each body takes in consequence of their action or connection; and he expresses this universal fact by a very simple formula; and, calling this also a principle, he solves every question with ease and neatness, by reducing it to the investigation of those velocities. In this way he has written a complete system of dynamics, to which he gives the title of *Mécanique Analytique*, full of the most ingenious and elegant solutions of very interesting and difficult problems; and all this without drawing a line or figure, but accomplishing the whole by algebraic operations.

But this is not teaching mechanical philosophy; it is merely employing the reader in algebraic operations, each of which he perfectly understands in its quality of an algebraic or arithmetical operation, and where he may have the fullest conviction of the justness of his procedure. But all this may be (and, in the hands of an expert algebraist, it generally is), without any notions, distinct or indistinct, of the things or the process of reasoning that are represented by the symbols made use of. (B. B. B.)

DYNAMOMETER, an instrument for ascertaining the relative strength of men and animals. Of an instrument of this kind, invented by Regnier, and of which a description is given in the *Journal de l'Ecole Polytechnique*, tom. ii. the author thus speaks: "Some important knowledge might be acquired, had we the easy means of ascertaining, in a comparative manner, our relative strength at the different periods of life, and in different states of health. Buffon and Guéneau, who had some excellent ideas on this subject, requested me to endeavour to invent a portable machine, which, by an easy and simple mechanism, might conduct to a solution of this question, on which they were then engaged. These philosophers were acquainted with that invented by Graham, and improved by Dr Desaguliers, at London; but this machine, constructed of wooden work, was too bulky and heavy to be portable; and, besides, to make experiments on the different parts of the body, several machines were necessary, each suited to the part required to be tried. They were acquainted also with the dynamometer of citizen Leroy of the Academy of Sciences at Paris. It consisted of a metal tube ten or twelve inches in length, placed vertically on a foot like that of a candlestick, and containing in the inside a spiral spring, having above it a graduated shank terminating in a globe. This shank, together with the spring, sunk into the tube in proportion to the weight acting upon it, and thus pointed out, in degrees, the strength of the person who pressed on the ball with his hand.

"This instrument, though ingenious, did not appear sufficient, however, to Buffon and Guéneau; for they wished not merely to ascertain the muscular force of a finger or hand, but to estimate that of each limb separately, and of all the parts of the body. I shall not here give an account of the attempts I made to fulfil the wishes of these

two philosophers, but only observe, that in the course of my experiments I had reason to be convinced that the construction of the instrument was not so easy as might have been expected. Besides the use which an enlightened naturalist may make of this machine, it may be possible to apply it to many other purposes. For example, it may be employed with advantage to determine the strength of draught cattle; and, above all, to try that of horses, and compare it with the strength of other animals. It may serve to make known how far the assistance of well-constructed wheels may favour the movement of a carriage, and what is its *vis inertiae* in proportion to the load. We might appreciate by it, also, what resistance the slope of a mountain opposes to a carriage, and be able to judge whether a carriage is sufficiently loaded in proportion to the number of horses that are to be yoked to it. In the arts, it may be applied to machines of which we wish to ascertain the resistance, and when we are desirous to calculate the moving force that ought to be adapted to them. It may serve, also, as a Roman balance to weigh burdens. In short, nothing would be more easy than to convert it into an anemometer, to discover the absolute force of the wind, by fitting to it a frame of a determined size filled up with wax cloth; and it would not be impossible to ascertain by this machine the recoil of fire-arms, and consequently the strength of gunpowder.

"This dynamometer, in its form and size, has a near resemblance to a common graphometer. It consists of a spring twelve inches in length, bent into the form of an ellipsis; from the middle of which arises a semicircular piece of brass, having engraved upon it the different degrees that express a force of the power acting on the spring. The whole of this machine, which weighs only two pounds and a half, opposes, however, more resistance

Dynamometer.

Dynasty than may be necessary to determine the action of the strongest and most robust horse."

DYNASTY, among ancient historians, signifies a race or succession of kings of the same family or line. Such were the dynasties of Egypt. The word is formed from the Greek *δυναστεία*, of *δυνατεω*, to be powerful.

DYSÆ, in *Mythology*, inferior goddesses among the Saxons, being the messengers of the great Odin, whose province it was to convey the souls of such as died in battle to his abode, called *Valhalla* or the hall of slaughter, where they were to drink, with him and their other gods, *cerevisia*, a kind of malt liquor, in the skulls of their enemies. The *Dysæ* conveyed those who died a natural death to *Hela*, the goddess of hell, where they were tormented with hunger, thirst, and every kind of evil.

DYSART, a royal burgh of Scotland, in the county of Fife, is situated on the coast of the Frith of Forth, about a mile to the eastward of Kirkaldy. It consists of three narrow streets, with a species of square in the centre. In the principal street there are a number of antique houses, the fronts of which are generally decorated with inscriptions and dates. Formerly this town enjoyed a considerable trade, and on this account was ennobled with the popular name of "Little Holland." The state of trade now, however, is far from corresponding with that ambitious title. The principal article manufactured is salt, which,

together with coal, is exported in quantities. The weaving of checks, ticks, and similar fabrics, is also carried on, and affords employment to a number of the inhabitants. The harbour of the town is tolerably good. Dysart was erected into a royal burgh in the beginning of the sixteenth century, and is at present governed by two bailies, a treasurer, and twenty-two councillors. Besides the parish church, there is a congregation connected with the Relief body. The town possesses a news-room and a mechanics' institution. The population of the burgh and parish amounted in 1821 to 6529, and in 1831 to 7104.

DYSCRASY, among physicians, denotes an ill habit or state of the humours, as in the scurvy, jaundice, and other diseases.

DYSENTERY, in *Medicine*, a diarrhoea or flux, where in the stools are mixed with blood, and the bowels miserably tormented with gripes. See *MEDICINE*.

DYSOREXY, among physicians, denotes a want of appetite, proceeding from a weakly stomach.

DYSPEPSY, a difficulty of digestion.

DYSPNŒA, a difficulty of breathing, usually called *asthma*.

DYVOUR, in *Scotch Law*, otherwise *Bare-man*, a person who, being involved in debt, and unable to pay the same, makes cession of his effects in favour of his creditors. The word is used in the same sense as *BANKRUPT*.

E.

E, the second vowel, and fifth letter of the alphabet. This letter is most probably derived from the old character in the ancient Hebrew and Phœnician alphabets, reversed by the Greeks to this position, E, not from the Hebrew *א*, as some have supposed. From the same origin is also derived the Saxon *e*, which is the first letter in their alphabet that differs from the Latin one. It is formed by a narrower opening of the larynx than the letter A; but the other parts of the mouth are used nearly in the same manner as in that letter. E has a long and short sound in most languages. The short sound is audible in *bed*, *fret*, *den*, and other words ending in consonants; the long sound is produced by a final *e*, or an *e* at the end of words, as in *glebe*, *here*, *hire*, *scene*, *sphere*, *interfere*, *revere*, *sincere*, and the like, in most of which it sounds like *ee*. In some other cases, this letter, by coming after *i*, is long, as in *believe*, *chief*, *grief*, *reprieve*; and sometimes the long sound is expressed by *ee*, as in *bleed*, *beer*, *creed*, and so on. Sometimes the final *e* is silent, and only serves to lengthen the sound of the preceding vowel, as in *rag*, *rage*, *stag*, *stage*, *hug*, *huge*. The sound of *e*, however, is obscure in the following words: *oxen*, *heaven*, *bounden*, *fire*, *massacre*, *maugre*, and other words. The Greeks have their long and short *e*, which they call *epsilon* ϵ , and *êta* η . The French have several kinds of *e*; the Latins have likewise a long and short *e*. In some instances the latter also write *e* instead of *a*, as *dicem* for *dicam*; and this is no doubt the reason why *a* is so often changed into *e* in the preter-perfect tense, as *ago*, *egi*; *facio*, *feci*, and the like.

As a numeral, E stands for 250, according to the verse,

E, quoque ducentos et quinquaginta tenebit.

In music it denotes the tone *e-la-me*; in the calendar it is the fifth of the dominical letters; and in sea charts it distinguishes all the easterly points. In ancient contrac-

tions and abbreviations E represents *Est*, *Ennius*, *Edilis*; EB, *Ejus Bona*; ED, *Ejus Domus*; EE, *Ejus Ætas*; EF, *Ejus Filius*; and so on.

EACHARD, JOHN, an English divine of great learning and wit in the seventeenth century, was bred at Cambridge, and was the author of *The Grounds and Occasions of the Contempt of the Clergy and Religion inquired into*, 1670. In 1675 he was chosen master of Catharine Hall upon the decease of Dr John Lightfoot; and the year following was created doctor in divinity by royal mandate. He died in 1697.

EACHARD, Laurence, an eminent English historian of the eighteenth century, was nearly related to Dr John Eachard. He was the son of a clergyman, who, by the death of his elder brother, became master of a good estate in Suffolk. He was educated in the university of Cambridge, entered into holy orders, and was presented to the living of Welton and Elkington in Lincolnshire, where he spent above twenty years of his life, and distinguished himself by his writings, especially his *History of England*, which was attacked by Dr Edmund Calamy and by Mr John Oldmixon. His *General Ecclesiastical History, from the Nativity of Christ to the first Establishment of Christianity by Human Laws under the Emperor Constantine the Great*, has passed through several editions. He was installed as archdeacon of Stowe and prebendary of Lincoln in 1712. He died in 1730.

EADMERUS, EADMER, or EDMER, an esteemed historian, was an Englishman by birth, but his parents, and the particular time and place of his nativity, are not known. He received a learned education, and early discovered a taste for history, by recording every remarkable event which came to his knowledge. Being a monk in the cathedral of Canterbury, he had the happiness to become the bosom friend and inseparable companion of two arch-

Dyscrasy
||
Eadmerus.

Eagle.

bishops of that see, St Anselm and his successor Ralph. To the former of these he was appointed spiritual director by the pope; and that prelate did nothing without his approbation. In the year 1120 he was sent for by King Alexander I. of Scotland, to be raised to the primacy of that kingdom; and having obtained leave of King Henry and the Archbishop of Canterbury, he departed for Scotland, where he was kindly received by the king, and on the third day after his arrival elected bishop of St Andrews; but on the day after his election a dispute unfortunately arose between the king and him, in a private conference about his consecration. Eadmerus having been a constant companion of two archbishops of Canterbury, was a violent stickler for the prerogatives of that see; and therefore told the king that he was determined to be consecrated by none but the Archbishop of Canterbury, whom he believed to be the primate of all Britain. Alexander, who was naturally a fierce prince, and supported the independence of his crown and kingdom with great spirit, was so much offended that he broke off the conference in a violent passion, declaring that the see of Canterbury had no pre-eminency over that of St Andrews. This breach between the king and the bishop-elect became daily wider, until at length Eadmerus, despairing of recovering the royal favour, sent his pastoral ring to the king; laid his pastoral staff upon the high altar, whence he had taken it; and abandoning his bishopric, returned to England. He was kindly received by the Archbishop and clergy of Canterbury, though they disapproved of his stiffness, and thought him too hasty in forsaking the honourable station to which he had been called. Nor was it long before Eadmerus became sensible of his error, and desirous of correcting it. With this view he wrote a long submissive letter to the king of Scotland, entreating his leave to return to the bishopric, and promising compliance with his royal pleasure in every thing respecting his consecration; which letter was accompanied by an epistle to the same purpose from the archbishop. These overtures, however, which were made in the year 1122, did not produce the desired effect. But Eadmerus is most worthy of the grateful remembrance of posterity for his historical works, particularly for his history of the affairs of England in his own time, from the year 1066 to the year 1122; a work in which he has inserted many original papers, and preserved many important facts which are nowhere else to be found. This work has been highly commended for its authenticity, as well as for regularity of composition and purity of style. It is indeed more free from legendary tales than any other work of this period; and it is impossible to peruse it with attention, without conceiving a favourable opinion of the learning, good sense, sincerity, and candour of its author.

EAGLE. See ORNITHOLOGY.

EAGLE, in *Heraldry*, is accounted one of the most noble bearings in armory, and, according to the learned in this science, ought to be given to none but such as greatly excel in the virtues of generosity and courage, or have rendered singular service to their sovereigns; in which case they may be allowed a whole eagle, or an eagle naissant, or only the head or such other parts as may be judged most agreeable to their exploits.

The eagle has been borne as an ensign or standard by several nations. The first who seem to have assumed the eagle were the Persians, according to the testimony of Xenophon; but subsequently it was adopted by the Romans, who, after a great variety of standards, at length fixed on the eagle, in the second year of the consulate of C. Marius, having till that period used indifferently wolves, leopards, and eagles, according to the humour of the commander. The Roman eagles, it must be observed, were not painted on a cloth or flag, but were figures in relief,

formed of silver or gold, and borne on the tops of pikes; the wings being displayed, with frequently a thunderbolt in the talons. Under the eagle on the pike were piled bucklers, and sometimes crowns.

Constantine is said to have been the first who introduced the eagle with two heads, to intimate, that though the empire seemed divided, it had yet only one body. Others say that it was Charlemagne who resumed the eagle as the Roman ensign, and added to it a second head; but that opinion is destroyed by an eagle with two heads, observed by Lipsius on the column of Antoninus, as also by the eagle's having only one head on the seal of the golden bull of the Emperor Charles IV. The conjecture, therefore, of Menestrier appears more probable; namely, that the emperors of the East, when there were two on the throne at the same time, struck their coins with the impression of a cross with a double traverse, which each of them held in his hand, as being the symbols of the Christians; and that they did the like with the eagle in their ensigns, and instead of doubling, joined them together, representing them with two heads; a practice in which they were followed by the emperors of the West. But this conjecture of Menestrier is not confirmed by ancient coins, without which Papebroche inclines to think the use of the eagle with two heads to have been merely arbitrary, though he admits it to be probable that it was first introduced on occasion of there being two emperors on the same throne.

The eagle on medals is, according to Spanheim, a symbol of divinity and providence, and, according to all other antiquaries, of empire. The princes on whose medals it is most usually found are the Ptolemies, and the Seleucidæ of Syria. An eagle with the word *consecratio* expresses the apotheosis of an emperor.

EAGLE, in *Astronomy*, is a constellation of the northern hemisphere, having its right wing contiguous to the equinoctial. See AQUILA.

White EAGLE, is a Polish order of knighthood, instituted in 1325 by Vladislaus V. on marrying his son Casimir to a daughter of the grand duke of Lithuania. The knights of this order were distinguished by a gold chain which they wore on the stomach, and to which was suspended a silver eagle crowned.

Black EAGLE, a similar order instituted in 1701 by the elector of Brandenburg, on his being crowned king of Prussia. The knights of this order wore an orange-coloured ribbon, to which was suspended a black eagle.

EAGLE ISLAND, an island in the South Pacific Ocean, near the north-east coast of New Holland, between Lizard Island and Cape Flattery. Lat. 14. 32. S.

EAGLES, a name frequently found in the ancient histories of Ireland, and used to express a sort of base money which was current in that kingdom in the early part of the reign of Edward I. that is, about the year 1272. There were, besides the eagles, lionines, rosades, and many other coins of the same sort, named according to the figures they were impressed with.

The current coin of the kingdom at that time was a composition of copper and silver, in determinate proportions; but these were so much inferior to the standard proportion of that time, that they were not intrinsically worth half so much as the others. They were imported from France and other foreign countries. When Edward had been a few years established on the throne, he set up mints in Ireland for coining good money, and then decried the use of eagles, and other kinds of base coin, making it death, with confiscation of effects, to import any more of them into the kingdom.

EAGLET, a diminutive of eagle, properly signifying a young eagle. In heraldry, when there are several eagles on the same escutcheon, they are termed *eaglets*.

Eagle
Island
||
Eaglet.

Ealderman
||
Earnest.

EALDERMAN, or **EALDORMAN**, among the Saxons, was of the same import with earl among the Danes. The word was also used for an elder, senator, or statesman; and hence, at this day, we call those functionaries *aldermen* who are associates to the chief officer in the common council of a city or corporate town.

EALING, a town of the county of Middlesex, five miles and a half from London, divided into two parts, distinguished by the names of East and West Ealing. It is in the hundred of Ossulston, and the parish includes the town of Old Brentford. It contains a handsome modern church, and several chapels for separatists, with some elegant villas. The population amounted in 1801 to 5035, in 1811 to 5361, in 1821 to 6608, and in 1831 to 7783.

EAR. (See **ANATOMY**.) The ear has its beauties, which a good painter ought by no means to disregard; and where it is well formed it would be an injury to the head were it hidden. Suetonius insists particularly on the beauty of Augustus's ears; and Ælian, describing the beauties of Aspasia, observes that she had short ears. Martial also ranks large ears amongst the number of deformities. Amongst the Athenians it was a mark of nobility to have the ears bored or perforated; but amongst the Hebrews and Romans this was a type of servitude.

EAR, in *Music*, denotes a kind of internal sense, by which we perceive and judge of harmony and musical sounds. In music we seem universally to acknowledge something like a sense distinct from the external one of hearing, and call it a *good ear*; and a similar distinction we should probably acknowledge in other affairs, if we had distinct names by which to denote these powers of perception. Thus a greater capacity of perceiving the beauties of painting, sculpture, and architecture, is called a *fine taste*.

EARING, in nautical language, is that part of the bolt rope which at the four corners of the sail is left open, in the shape of a ring. The two uppermost parts are put over the ends of the yard-arms, and so the sail is made fast to the yard; and into the lowermost earings the sheets and tacks are seized or bent at the clew.

EARL, a British title of nobility, next below a marquis, and above a viscount. The title is so ancient, that its origin cannot now be clearly traced out. It seems tolerably certain, however, that amongst the Saxons they were called *ealdormen*, elder men, a word of the same signification with *senior* or *senator* among the Romans; and also *schiremen*, because they had each of them the civil government of a civil division or shire. On the irruption of the Danes they changed their names to *eorels*, which, according to Camden, had the same signification in their language. In Latin they are called *comites*, a title first used in the empire, from being the king's attendants; *a societate nomen sumpserunt, reges enim tales sibi associant*. After the Norman conquest they were for some time called *counts*, from the French; but they did not long retain that name themselves, though their shires are thence denominated *counties* to this day. It is now become a mere title, the holders of which have nothing to do with the government of the county, that being now entirely devolved on the sheriff, the earl's deputy or *vicecomes*. In writs, commissions, and other formal instruments, the king, when he mentions any peer of the degree of an earl, usually styles him trusty and well-beloved cousin; an appellation as ancient as the reign of Henry IV., who being, either by his wife, his mother, or his sisters, actually related or allied to every earl in the kingdom, artfully and constantly acknowledged that connection in all his letters and other public acts; whence the usage descended to his successors, though the reason has long ago failed.

EARNEST (**ARRHÆ**), money advanced in order to

bind the parties to the performance of a verbal bargain. By the civil law, he who recedes from his bargain loses his earnest, and if the person who received the earnest give back, he must return the earnest double. But with us, the person who gives it is in strictness obliged to abide by his bargain; and in case he decline it, he is not discharged upon forfeiting his earnest, but may be sued for the whole money stipulated.

EARTH, amongst ancient philosophers, one of the four elements of which the whole system of nature was believed to be composed.

EARTH, in *Astronomy* and *Geography*, one of the primary planets, being the terraqueous globe which we inhabit. (See the articles **FIGURE OF THE EARTH**, and **GEOLOGY**.)

EARTHS, in *Chemistry*. These bodies will be found described in the article **CHEMISTRY**, under the heads *Alkaline Bases* and *Earthy Bases*.

EASEL PIECES, among painters, such small pieces, whether portraits or landscapes, as are painted on the easel, or frame whereon the canvass is laid. They are thus denominated in order to distinguish them from larger pictures drawn on walls, ceilings, and the like.

EASING, in the sea language, signifies the slackening of a rope or the like. Thus, to ease the bow line, or sheet, is to let them go slacker; to ease the helm, is to let the ship go more large, more before the wind, or more larboard.

EASINGWOLD, a market-town in the north riding of the county of York, 208 miles from London and 11 from York. It is in the wapentake of Bulmer. It has a market on Friday, where much butter and bacon, cured in the neighbourhood, are disposed of for distant places. The population amounted in 1801 to 1467, in 1811 to 1576, in 1821 to 1912, and in 1831 to 2381.

EAST, one of the four cardinal points of the world, being that point of the horizon where the sun is seen to rise when in the equinoctial. The word *east* is Saxon. In Italy, and throughout the Mediterranean, the east wind is called the *levante*; in Greek, *ανατολη* and *απηλωσης*, because it comes from the side of the rising sun, *απ' ηλιου*, in Latin *Eurus*.

EASTBOURNE, a town on the coast of Sussex, in the hundred of that name, within the rape of Pavensay. It is 63 miles from London, and is one of those places which, from the prevalence of sea-bathing, has within the last fifty years been raised from a fishing village to be a large and populous town. It is situated in a chasm between two cliffs, through which runs a small stream. One of these, Beachy Head, is the loftiest headland on the English Channel. It consists of three distinct parts, each near half a mile from the other. The resident population amounted in 1801 to 1668, in 1811 to 1806, in 1821 to 2607, and in 1831 to 2726; but the visitors are said to be much more numerous during the bathing season.

EAST ISLAND, a small island in the Eastern Seas, near the coast of Patawan. Long. 118. 36. E. Lat. 8. 40. N. Also a small island on the east coast of Borneo. Long. 109. 38. E. Lat. 2. 40. N. Likewise an island in the South Pacific Ocean, on the coast of New Zealand, near Cape East.

EASTER, a festival of the Christian church, observed in memory of our Saviour's resurrection. The Greeks call it *pasga*, the Latins *pascha*, from a Hebrew word signifying *passage*, applied to the Jewish feast of the passover. It is called *Easter* in English, from the goddess Eostre, who was worshipped by the Saxons with peculiar ceremonies in the month of April. The Asiatic churches kept their Easter upon the very same day on which the Jews observed their passover, and others on

Earth
||
Easter.

Easter
Island
||
Eberhard.

the first Sunday after the first full moon in the new year. This controversy was determined in the council of Nice, when it was ordained that Easter should be kept upon one and the same day, which should always be a Sunday, in all Christian churches in the world.

EASTER ISLAND, an island in the South Sea, lying in Long. 109. 46. W. Lat. 27. 5. N. See the article POLYNESIA.

EASTON, a post-town and burgh of Pennsylvania, and capital of the county of Northampton, United States. It is situated on the Delaware, at the junction of the Lehigh River and Canal, and also near the western end of the Morris Canal, which connects it with New York. It is regularly laid out, handsomely built, and possesses a considerable trade. In the vicinity of this place there are several valuable mills. The situation of the town is low, and it is surrounded by considerable eminences. Here there is a bridge across the Delaware, 570 feet in length. The population in 1820 amounted to 2370. and has since increased. It is distant 60 miles north of Philadelphia, and 73 west of New York.

EASTPORT, a post-town and sea-port of Maine, in the county of Washington, situated at the most eastern limit of the United States, on Morse Island, in Passamaquoddy Bay. It is a flourishing commercial place, and is very well situated for trade, having ample facilities for communication with the interior, by means of two rivers which flow into the bay. Its harbour is very capacious, and of safe entrance, and is considered as one of the best in the United States. About 1500 tons of shipping belong to it. The exports consist of lumber, and provisions of various kinds. The population in 1820 amounted to 1937. Long. 66. 56. W. Lat. 44. 54. N.

EAUZE, an ancient city of the department of Gers, in France, said to have been taken by the Saracens in 722. It is situated on the river Selise, was formerly called Elusa, and is the chief place in Aquitain. It now contains 3220 inhabitants. Long. 0. 3. W. Lat. 43. 56. N.

EAVES, in *Architecture*, the margin or edge of the roof of a house, being the lowest tiles, slates, or the like, which hang over the walls, in order to throw off water to a distance from the foundations.

EAVES-DROPPERS, are such persons as stand under the eaves or walls and windows of a house, by night or by day, to hearken after news, and carry it to others, and thereby cause strife and contention in the neighbourhood. They are called by the *Stat. of West. i. c. 33*, *evil members of the commonwealth*.

EBDOMARIUS, or HEBDOMARIUS, in ecclesiastical writings, an officer formerly appointed weekly to superintend the performance of divine service in cathedrals, and prescribe the duties of each person attending in the choir, as to reading, singing, praying, and the like. For this purpose the hebdomary, at the beginning of his week, drew up in form a bill or writing of the respective persons, and their several offices, called *tabula*, and the persons there entered were styled *intabulati*.

EBDOME, Εβδομή, in *Antiquity*, a festival kept on the seventh of every lunar month, in honour of Apollo, to whom all seventh days were sacred, because one of them was his birth-day; and hence he was sometimes called *Ebdomāgenes*.

EBERBACH, a bailiwick in the circle of the Neckar, in the duchy of Baden, in Germany, comprehending one city and nineteen villages, with 7890 inhabitants. The capital, of the same name, is situated on the Neckar, and has 2843 inhabitants.

EBERHARD, JOHN AUGUSTUS, an eminent German theologian and philosopher, was born at Halberstadt, in Lower Saxony, on the 31st of August 1739. His father

was the singing-master at the church of St Martin's in that town, and also teacher of the school of the same name; a man, it is said, of a lively disposition, and considerable literary attainments. Young Eberhard was educated partly at home and partly in the school above mentioned. In the seventh year of his age he repaired to the University of Halle, with the view of prosecuting his theological studies. Towards the end of the year 1759 he returned to his native town, and became tutor to the eldest son of the Baron Von der Horst, to whose family he attached himself for a number of years. In the year 1763 he was appointed con-rector of the school of St Martin's, and second preacher in the Hospital Church of the Holy Ghost; but he soon afterwards resigned these offices, and followed his patron to Berlin.

The advantages he enjoyed, in this family, of being introduced into the best company, tended to polish his manners, and to form, even at an early period, a style of writing which served as a model to many of his contemporaries. His residence at Berlin gave him an opportunity of extending his knowledge, and of cultivating the acquaintance of some of the most eminent literary characters in Germany. Amongst these were Nicholai and Mendelssohn, with whom he associated upon terms of intimate friendship.

In the year 1768 he accepted the situation of preacher or chaplain to the work-house at Berlin, along with that of preacher in the neighbouring fishing village of Stralow. The income from these livings was small; but his object was to continue at Berlin, and he had at the same time the promise of further preferment upon the first vacancy. He now applied, with renewed ardour, to the study of theology, philosophy, and history; and the first fruits of his talents and application soon appeared in his *New Apology of Socrates*; a work exhibiting such originality of thought and eloquence of style as at once established his character as a writer. This work was occasioned by an attack which was made on the sentiments contained in the fifteenth chapter of Marmontel's *Belisarius*, by one Peter Hofstede, a clergyman of Rotterdam, who, with a contemptible industry, raked up the vices of the most celebrated characters in the pagan world, and even went so far as to maintain that the most virtuous amongst the heathen were no fit objects of divine mercy. He seemed particularly desirous to blacken the character of Socrates; and from this circumstance Eberhard was induced to give to his work the title which we have mentioned above. The greater part of it is occupied with an investigation of some of those peculiar doctrines which have been admitted as dogmas of the Christian church, upon the authority of some of the early fathers; and an examination of those texts of Scripture upon which they are founded. The *Apology* itself, which constitutes but a small part of the book, is esteemed a masterpiece of clear, dignified, and persuasive eloquence. The whole work exhibits much reading and philosophical reflection; but the liberality of his reasoning gave great offence to many of the strictly orthodox divines of his time, and is believed to have obstructed his preferment in the church.

In the year 1774 he was appointed to the living of Charlottenburg; and he employed the leisure he had in this situation in publishing a second volume of his *Apology*; in which he not only endeavours to obviate some objections which were taken to the former part, but continues his inquiries into the doctrines of the Christian religion, religious toleration, and the proper rules for interpreting the Scriptures. Perceiving that his further promotion in the church would be attended with difficulty, he resolved, although reluctantly, to accept the situation of professor of philosophy at the University of Halle,

Eberhard. which became vacant in 1778, by the death of G. F. Moier. But however excellent as a writer, and however just his ideas upon philosophical subjects, he does not appear to have been peculiarly qualified to excel as a teacher. He was highly esteemed, indeed, both by professors and students; but his lectures, although they attracted at first a considerable concourse, never acquired any degree of popularity. He continued, however, to lecture very regularly; and published several manuals for the use of his pupils.

On his arrival at Halle, the philosophical faculty presented him with a diploma as doctor in philosophy and master of arts. In 1786 he was admitted a member of the Berlin Academy of Sciences; and in 1805 the king of Prussia conferred upon him the honorary title of a privy councillor. In 1808 he obtained the degree of doctor in divinity, which was given him as a reward for his theological writings. He married in 1778, but had no children. He died on the 6th of January 1809, being then in the seventieth year of his age.

Eberhard's attainments in philosophy and literature were extensive and profound. He was master of the learned languages, spoke and wrote French with facility and correctness, and understood English, Italian, and Dutch. He had read a great deal, was thoroughly versed in the philosophical sciences, and possessed a just and discriminating taste for the fine arts. He was a great lover of music, and was himself a proficient in that science. His manners were mild and unassuming; and his amiable and cheerful disposition, no less than his talents and virtues, endeared him to a numerous circle of friends.

The following is a list of his works:

Neue Apologie des Sokrates, &c. 2 vols. 8vo. The first volume was published in 1772, the second in 1778; both have been since republished.

Allgemeine Theorie des Denkens und Empfindens, &c. Berlin, 1776, 8vo. This essay obtained the prize assigned by the Royal Society of Berlin for that year. A new edition appeared in 1786.

Von dem Begriff der Philosophie und ihren Theilen, Berlin, 1778, 8vo. A short essay, in which he announced the plan of his lectures on being appointed to the professorship at Halle.

Lobschrift auf Herrn Johann Thunmann, Prof. der Weltweisheit und Beredsamkeit auf der Universität zu Halle. Halle, 1779, 8vo.

Amyntor, eine Geschichte in Briefen. Berlin, 1782, 8vo. This work was written with the view of counteracting the influence of those sceptical and Epicurean principles in religion and morals which were then so prevalent in France, and thence rapidly spreading amongst the higher ranks in Germany. It is composed with great elegance and perspicuity, and exhibits much philosophical reflection, and knowledge of the world. The story is simple, and seems to have been merely intended as a vehicle for the sentiments.

Ueber die Zeichen der Aufklärung einer nation, &c. Halle, 1783, 8vo. A lecture delivered at Halle, in presence of his Serene Highness the reigning Duke of Wurtemberg.

Theorie der Schönen Künste und Wissenschaften, &c. Halle, 1783, 8vo. 3d ed. 1790.

Vermischte Schriften. Halle, 1784.

Neue vermischte Schriften. Ib. 1786.

Allgemeine Geschichte der Philosophie, &c. Halle, 1788, 8vo; 2d ed. with a continuation and chronological tables, 1796. Eberhard published also an abridgment of this work in 1794.

Versuch einer Allgemeinen-Deutschen Synonymik, &c. Halle and Leipsic, 1795-1802, 6 vols. 8vo. This is esteemed a classical work on the Synonymes of the German Language. An abridgment of it was published by the author in one large volume 8vo. Halle, 1802.

Handbuch der Aesthetik, &c. Halle, 1803-1805, 4 vols. 8vo.

Besides the works above mentioned, Eberhard contributed a number of small tracts and essays to various periodical and scientific publications, and translated several foreign works. He was also the editor of the *Philosophical Magazine*, Halle, 1788-1792, and of the *Philosophical Archives*, Halle, 1793-1795. These two periodical works, which are now little read, were instituted for the purpose of controverting the metaphysical principles of Kant, and of vindicating the doctrines of Leibnitz and Wolf.

Frederick Nicolai published a Memoir on the life and character of Eberhard, Berlin and Stettin, 1810, 8vo. See also K. H. Jördens, *Lexicon Deutscher Dichter und Prosaisten*; and *Biographie Universelle*.

EBERMANSTADT, a bailiwick of the circle of the Upper Maine, in the kingdom of Bavaria, extending over ninety-two square miles, containing one city, two market-towns, and thirty-three villages, with 9690 inhabitants. The chief place is the town of that name, situated on the river Wiesent, with 650 inhabitants.

EBERN, a bailiwick of the circle of the Lower Maine, in the kingdom of Bavaria, extending over seventy-one square miles. It contains one city, one market-town, and 11,400 inhabitants. It is watered by the river Baunach, has excellent pasture, and moderate corn land. The capital, of the same name, contains 207 houses, and 1100 inhabitants employed in making glass and porcelain wares.

EBERSBACH, a town of the circle of Lausatia, in the kingdom of Saxony. It contains 700 houses and 5400 inhabitants, who have more than 1500 looms at work making linen.

EBERSBERG, a bailiwick in the circle of the Isar, of the kingdom of Bavaria, extending over 240 square miles. It contains three market-towns, 148 villages, and 3436 houses, with 16,187 inhabitants. The chief town is of the same name, and contains 176 houses and 940 inhabitants.

EBERSDORF, a market-town of the principality of Reuss of the Branch. It contains the prince's castle, and 1270 inhabitants, of whom about 400 are industrious Hutterers or Moravians. It is the capital of a bailiwick of the same name, which comprehends one other town and fourteen villages. There is a town of the same name in Austria, but very small, and known as the lodging of Bonaparte the night before the battle of Aspern.

EBESFALVA, a city of the Austrian kingdom of Hungary, in the province of Magyaren and circle of Kohelburg. It is well built, and contains an Arminian, a Greek, and a Calvinist church, with 4200 inhabitants, employed in manufactures and trade. Long. 13. 30. 16. E. Lat. 46. 11. 48. N.

EBHER, a town of Persia, in the province of Irak, situated on a river of the same name, in a fertile country. It contains 1000, or, as some say, 2500 houses, and has mosques, caravanserais, bazars, and other public edifices. It is thirty miles west of Casbin.

EBINGEN, a city of the kingdom of Bavaria, in the province of the Black Forest and circle of Bahlingen. It stands on the river Schmeica, and contains 4350 inhabitants, the most industrious manufacturers of woollen goods, hosiery, hats, and leather of any in that kingdom. Most of the goods made by them are disposed of at the fairs of Frankfort and of Zurzach. Long. 10. 58. E. Lat. 48. 13. 40. N.

EBION, the author of the heresy of the Ebionites, was a disciple of Cerinthus, and successor to that person. He improved upon the errors of his master, and added to them new absurdities of his own. He began his preaching

Eberman-
stadt
||
Ebion.

Ebionites. in Judea; and he taught in Asia, and even at Rome. His tenets infected the isle of Cyprus. St John opposed both Cerinthus and Ebion in Asia; and it is thought that this apostle wrote his gospel in the year 97 in order to overthrow this heresy.

EBIONITES, ancient heretics, who appeared in the church in the first ages, and formed themselves into a sect in the second century, denying the divinity of Jesus Christ.

Origen conceives them to have been so called from the Hebrew word *ebion*, signifying *poor*, because, according to him, they were poor in sense, and wanted understanding. Eusebius, with a view to the same etymology, is of opinion they were so called from having poor thoughts of Jesus Christ, by taking him for a mere man. But it is more probable the Jews gave this appellation to the Christians in general out of contempt; because in the first ages there were few except poor people who embraced the Christian religion. This opinion Origen himself seems to incline to in his book against Celsus, where he says that they called those among the Jews who believed that Jesus was truly the expected Messiah, Ebionites. It might even be urged, with some probability, that the primitive Christians assumed the name themselves, in conformity with their profession; and it is certain that they valued themselves on being poor, in imitation of the apostles. Epiphanius, however, is of opinion that there had been a man named Ebion, the chief and founder of the sect of Ebionites, and contemporary with the Nazarenes and Cerinthians; and he gives a long account of the origin of the Ebionites, stating that they arose after the destruction of Jerusalem, when the first Christians, called Nazarenes, went out in order to live at Pella.

The Ebionites were little else than a branch of Nazarenes, only that they altered and corrupted in many things the purity of the faith as held by the first adherents of Christianity. For this reason Origen, in his answer to Celsus, distinguishes two kinds of Ebionites; one of whom believed that Jesus Christ was born of a virgin, and the other that he was born after the manner of other men. The first were orthodox in every thing, except that to the Christian doctrine they joined the ceremonies of the Jewish law, together with the traditions of the Pharisees. They differed from the Nazarenes, however, in several things, particularly as to the authority of the sacred writings; for the Nazarenes received all as Scripture that was contained in the Jewish canon, whereas the Ebionites rejected the prophets, holding the very names of David, Solomon, Isaiah, Jeremiah, and Ezekiel in abhorrence, and also the Epistles of St Paul, whom they treated with the utmost disrespect. They received nothing of the Old Testament except the Pentateuch; a circumstance which indicates that they were descended rather from the Samaritans than from the Jews. They agreed with the Nazarenes in using the Hebrew gospel of St Matthew, otherwise called the Gospel of the Twelve Apostles; but they had corrupted their copy in many places, and, particularly, had left out the genealogy of our Saviour, which was preserved entire in that of the Nazarenes, and even in those used by the Cerinthians.

Some, however, have made this gospel canonical, and of greater value than our present Greek gospel of St Matthew. The Nazarenes, whose sentiments as to the birth of our Saviour were the same with those of the Ebionites, built their error on this very genealogy.

Besides the Hebrew gospel of St Matthew, the Ebionites had adopted several other books, under the names of St James, St John, and the other apostles; they also made use of the travels of St Peter, which are supposed to have been written by St Clement, but altered them so that

scarcely any truth was left in them; and in order the better to authorize their own practices, they even made that saint tell a number of falsehoods. (See St Epiphanius, who is very diffusive on the ancient heresy of the Ebionites, *Hær.* 30. But his account deserves little credit, as, by his own confession, he has confounded the other sects with the Ebionites, and has charged them with errors to which the first adherents of this sect were utter strangers.)

EBONY, a species of wood, exceedingly hard and heavy, susceptible of a very fine polish, and on that account used in mosaic and inlaid works, toys, and the like. There are different kinds of ebony, but the most usual amongst us are black, red, and green, and almost all of them the product of the island of Madagascar, where the natives call them indifferently *hazon mainthi*, or *black wood*. The island of Mauritius likewise furnishes part of the ebonies used in Europe. Authors and travellers give very different accounts of the tree which yields the black ebony. According to some of their descriptions, it would appear to be a sort of palm tree; but according to others, a cytissus. The most authentic of these is that of Falcourt, who resided many years in Madagascar as governor. He assures us that it grows very high and large, its bark being black, and its leaves resembling those of our myrtle, of a deep dusky green colour. Tavernier says that the islanders always take care to bury their trees when cut down, in order to make them blacker, and to prevent their splitting when wrought. Plumier mentions another black ebony tree, discovered by him at St Domingo, which he calls *spartium portulacæ foliis aculeatum ebeni matericæ*.

Pliny and Dioscorides state that the best ebony comes from Ethiopia, and the worst from India; but Theophrastus prefers that of India. Black ebony is much preferred to that of other colours. The best is a jet black, free of veins and rind, very massive, astringent, and of an acrid pungent taste. Its rind, infused in water, is said to purge pituita, and cure venereal disorders; and hence Matthioli took guaiacum for a sort of ebony. It yields an agreeable perfume when laid on burning coals; when green it readily takes fire from the abundance of its fat. If rubbed against a stone it becomes brown. The Indians make statues to their gods and sceptres for their princes out of this wood. It was first brought to Rome by Pompey after he had subdued Mithridates. It is now much less used amongst us than anciently, since the discovery of so many ways of giving other hard woods a black colour.

As to the green ebony, besides Madagascar and the Mauritius, it grows likewise in the Antilles, and especially in the isle of Tobago. The tree which yields it is very bushy; its leaves are smooth, and of a fine green colour. Beneath its bark there is a white blea, about two inches thick; and all beneath this, to the very heart, is a deep green, approaching towards a black, though sometimes streaked with yellow veins. Its use is not confined to mosaic work; it is likewise employed in dyeing, as yielding a fine green tincture. As to red ebony, called also *grenadilla*, we know little more of it than the name.

EBRO, a river of Spain. It has its source in the province of Toro, about ten miles west of Reynosa, from out of the two springs of Fontibre, whence it runs south-east, divides Burgos and Soria from Alava and Navarre, passes through Aragon, becomes navigable near Logrono, and, after a course of 362 miles near Amposta, empties itself into the Gulf of Alfaques. Its tributary streams are the Tadorra, the Ega, the Queiles, the Alhama, the Xalon, the Gallega, the Guadalupe, and the Segre.

EBUDÆ, or **HEBUDÆ**, in *Ancient Geography*, islands off the west coast of Scotland, now called the *Western Isles*, also *Hebrides*.

Ecalesia
||
Ecbatana.

ECALLESIA, *Εκαλλήσια*, in *Antiquity*, a festival held in honour of Jupiter, surnamed *Hecalus*, or *Hecalesius*, from *Hecale*, one of the boroughs in Attica.

ECASTOR, in *Antiquity*, an oath in which Castor was invoked. It was a custom for the men never to swear by Castor, nor the women by Pollux.

ECATÆA, *Εκαταία*, in *Antiquity*, statues erected to the goddess Hecate, for whom the Athenians had a great veneration, believing that she was the overseer of their families, and that she protected their children.

ECATESIA, *Εκατησία*, in *Antiquity*, an anniversary solemnity, observed by the Stratonicensians, in honour of Hecate. The Athenians likewise had a public entertainment or supper every new moon, in honour of the same goddess. The supper was provided at the charge of the more affluent; and it was no sooner brought to the accustomed place than the poor people carried all off, giving out that Hecate had devoured it. For the rest of the ceremonies observed on this occasion, see Potter, *Arch. Græc.* lib. ii. cap. 20.

ECATOMBÆON, *Εκατομβαιων*, in *Chronology*, the first month of the Athenian year. It consisted of thirty days, and began on the first new moon after the summer solstice, and consequently answered to the latter part of our June and beginning of July. The Bæotians called it *Hippodromus*, and the Macedonians *Lous*. The word is a derivation from the Greek *ἡκατομβή*, a *hecatomb*, because of the number of hecatombs sacrificed in it.

ECAVESSADE, in the manège, is a term used for a jerk of the cavesson.

ECBATANA, more properly written Agbatana, the chief city of Media, and the summer residence of its princes. Its foundation is ascribed by Herodotus to Dejoces, first king of Media, who reigned about 733 B. C.; but as this period of history is involved in much obscurity, we have some reason to doubt the correctness of his statement. The account of Diodorus, ii. 13, proves that it existed at a still earlier period, and belonged to that era in the Median history which preceded the reign of Semiramis. That princess, who is supposed to have lived about 1916 B. C., indulged her love of magnificence by the erection of a royal palace within its walls; and finding the city in great want of water, she constructed a splendid aqueduct, which furnished a plentiful supply of that first necessary of life. Pliny, vi. 14, would have us believe that Seleucus Nicator was the founder; but as this prince lived about 320 B. C. we cannot give credit to this statement, except he means that Seleucus became its second founder, after it had suffered from the calamities of war.

The citadel was remarkable for strength, and constructed in a very peculiar manner. Being situated upon a hill, it was surrounded by seven walls, in such a way that the bulwarks of the one wall rose high above those of the other, whilst each of them was distinguished by its own particular colour. The circumference of the outermost wall was equal to that of the city of Athens, or rather to 240 stadia, according to Diodorus; but this wonderful account ought to be received with some degree of hesitation.

Ecbatana was from the most ancient times the place of the royal residence, and seems in splendour and magnificence to have far exceeded all other cities. It was to it that Cyrus carried the captive Cræsus, 546 B. C. when he put an end to the Lydian empire; and in the later years of his life, when the infirmities of age made him more susceptible of the vicissitudes of the seasons, he used to retire for the summer months to its cool and delicious shades. (Xen. *Cyrop.* viii. 6.) Here Artaxerxes assembled his army to oppose the designs of his brother Cyrus (Diodorus xiv. 22); and when the fate of Persia was decided by the

battle of Arbela, this was the spot chosen by Darius as the rallying point for his fugitive soldiers. (xvii. 64.) But no sooner did Alexander show his determination to attack it, than Darius ingloriously fled, and Ecbatana fell, with all its riches, into the hands of the Macedonian conqueror. (Arrian, 3, 19, 4.) The magnificence of its palace is particularly remarked by Polybius, who tells us that the wood was all of cedar or of cypress; the beams, the ceilings, and the pillars that supported the porticoes, were covered, some with plates of silver, and some with plates of gold. The tiles likewise were all of silver. It was of course plundered by the Macedonians; yet in the time of Antiochus, 209 B. C. he still found there pillars cased with gold, and a large quantity of silver tiles laid together in a heap. Amidst all the changes of empire in the East we find that Ecbatana continued to a very late period one of its principal cities. Vologeses held his court within its walls 64 A. D. (Tacit. *Ann.* xv. 31.)

The site of this ancient town seems unquestionably to have been near Hamadan in Al Djebal, though some are inclined to place it at Tebriz in Aderbidjon; and a late writer, Mr Williams, has even attempted to prove it to have been at Ispahan. This opinion he supports with great ability, but it is nothing else than a splendid paradox. The chief authorities adduced to prove its position are the following: It is situated at the foot of Mount Orontes, Polyb. x. 27; twelve stadia distant from it, Diodor. ii. 13; twelve long days' journey from the Caspian Gates, Arrian, iii. 20; 450 miles from Gaza, the capital of Atropatene, Plin. vi. 13; from Susa fifteen days' journey, Diodor. xvii. 110; and twenty from Persepolis, xix. 46.

The country round Hamadan at present abounds in gardens, vineyards, and pasturages; and though it is a gloomy abode during winter, on account of the cold, it is a delightful residence during the summer months. The tomb of Esther is still pointed out, and continues to be visited by Jewish pilgrims (Otter, *Voyage en Turquie*, vol. i. p. 182); and also the tomb of Avicenna. Abdool Kerim's *Travels from India to Mecca*, p. 97. See MOUNT ORONTES.

ECHELLENSIS, ABRAHAM, a learned Maronite, whom the president Le Jai employed in the edition of his Polyglott Bible. Gabriel Sionita, his countryman, brought him to Paris in order to make him his fellow-labourer in publishing that Bible. But they quarrelled, upon which Gabriel complained to the parliament, and cruelly defamed his associate. This dispute made a great noise. The congregation *de Propaganda Fide* associated him in 1636 with those whom they had employed in making an Arabic translation of the Scriptures; they recalled him from Paris, and he laboured in that translation at Rome in the year 1652. Whilst he was professor of the oriental languages at Rome, he was selected by Duke Ferdinand II. to translate from Arabic into Latin the fifth, sixth, and seventh books of Apollonius's Conics; a task in which he was assisted by John Alphonso Borelli, who added commentaries to them. He died at Rome in 1644.

ECCLES, one of those large manufacturing towns which within a few years have risen from villages. It is 185 miles from London and four from Manchester, in the hundred of Salford, and county of Lancaster. The inhabitants are chiefly occupied in the several branches of the cotton manufacture; and amounted in 1801 to 6197, in 1811 to 12,300, in 1821 to 23,331, and in 1831 to 28,083.

ECCLESAL-BIERLOW, a large township of the parish of Sheffield, about three and a half miles from that town. The inhabitants are chiefly occupied in the various branches of the metal manufactures; and amounted in 1801 to 5362, in 1811 to 6569, in 1821 to 9113, and in 1831 to 14,279.

ECCLESFIELD, a large manufacturing parish of the

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Ecclesfield.

Eccleshall west riding of Yorkshire, in the wapentake of Strafforth and Tickhill, 167 miles from London and five from Sheffield, with the trade of which place it is very much connected. The population amounted in 1801 to 5114, in 1811 to 5805, in 1821 to 7163, and in 1831 to 7911.

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Echinades.

ECCLESHALL, a market-town of the county of Stafford, 148 miles from London. It is in the hundred of Pirehill, on the banks of the river Sow; is a well-built town, in a pleasant district; and was formerly the residence of the bishops of Lichfield. The chief part of the inhabitants are employed in manufactures. The market is held on Thursday. The population amounted in 1801 to 3487, in 1811 to 3901, in 1821 to 4227, and in 1831 to 4471.

ECCLESIASTES, a canonical book of the Old Testament, the design of which is to show the vanity of all sublunary things. It was composed by Solomon, who enumerates the several objects on which men place their happiness, and then shows the insufficiency of all worldly enjoyments. The Talmudists made King Hezekiah the author of this book; while Grotius ascribes it to Zorobabel, and others to Isaiah; but the generality of commentators believe it to be the product of Solomon's repentance, after having experienced all the follies and pleasures of life.

ECCLESIASTICAL, an appellation given to whatever belongs to the church. Thus we say ecclesiastical polity, jurisdiction, history, and so forth.

ECCLESIASTICUS, an apocryphal book, generally bound up with the Scriptures, and so called from its being read in the church, *ecclesia*, as a book of piety and instruction, but not of infallible authority. The author of this book was a Jew, called Jesus the son of Sirach. The Greeks call it the Wisdom of the Son of Sirach.

ECCLOO, a city in the province of West Flanders, which contains 6269 inhabitants. It is the capital of the circle of the same name, comprehending three cantons, with a population of 42,484 persons.

ECCOPROTICS, in *Medicine*, laxative or loosening remedies, which purge gently, by softening the humours and excrements, and fitting them for expulsion. The word is composed of the Greek particle *εκ*, and *κοπρος*, *feces*.

ECDALA, or **AKDALA**, an ancient town and fortress of Bengal, in the district of Dacca, which is frequently mentioned in the histories of Bengal, but of which there are now scarcely any remains. In the year 1353 Ilyas Hajy, the second independent king of Bengal, took refuge here, and defended the place until the setting in of the rains, when the siege was raised. Long. 96. 45. E. Lat. 24. 4. N.

ECDICI, *Εκδικοι*, amongst the ancients, patrons of cities, who defended their rights, and took care of the public money. Their office resembled that of the modern syndics.

ECHALLANS, a bailiwick in the canton of Vaud, in Switzerland, containing 6954 inhabitants, whose capital is of the same name, and situated on the river Talent, containing 850 inhabitants.

ECHAPE, in the manège, a horse begotten between a stallion and a mare of different breeds and countries.

ECHAPER, in the manège, a gallicism used in the academies, implying to give a horse head, or to put him to full speed.

ECHINADES, a group of islands off the coast of Acarnania, at the mouth of the river Achelous. They are mentioned by Homer as having sent a detachment of troops to Troy under Meges. The chief island seems to have been Dulichium, which some of the ancients considered as only another name for Cephallenia; but Strabo strenuously maintained that it was the Dolicha of his period, at the mouth of the Achelous. It is curious that Herodotus (xi. 10), tells us that more than half of these islands had been

joined in his time to the mainland by the depositions of the river, and Thucydides (xi. 102), enters into a learned disquisition to prove that they must all ere long be united to the shore. This observation of Thucydides had attracted the attention of the inquisitive Pausanias; and as he found that the prediction had not been verified, he was only able to account for it by supposing that the lands had ceased to be cultivated on its banks, and that thus it was no longer supplied with the same quantity of sediment as before. Strabo states that they were rugged and barren. "At present the Echinades belong to the inhabitants of Ithaca, and produce corn, oil, and a scanty pasture for sheep and goats. The name of the group is *Curzolari*." Dodwell's *Classical Tour*, v. p. 109. Gell states that several of these islands, now hills in the plain, appear to have ruins. *Itiner. of Greece*, p. 298.

ECHINATE, or **ECHINATED**, an appellation given to whatever is prickly, or resembling the hedgehog.

ECHINITES, the name by which authors call the fossil centronia, frequently found in chalk pits.

ECHINODERMATA, the first class of the fourth great division of the animal kingdom (see vol. iii. p. 179 of this work), commonly called Zoophytes, or radiated animals; it includes, among numerous other species, the star-fish, sea urchins, &c. We shall describe the animals of this class under the term **ZOOPHYTES**, to which the reader is referred.

ECHINUS. See **ZOOPHYTES**.

ECHO, a sound reflected or reverberated from a solid concave body, and so repeated to the ear. The word is formed from the Greek *ηχος*, *sound*, which comes from the verb *ηχων*, *sono*.

The ancients being wholly unacquainted with the true cause of the echo, ascribed it to several which are sufficiently whimsical. But the moderns, who know sound to consist in a certain tremor or vibration in the sonorous body, communicated to the contiguous air, and by that means to the ear, give a more consistent account of echo. For a tremulous body, striking on another solid body, may evidently be repelled without destroying or diminishing its tremor; and consequently a sound may be redoubled by the resiliency of the tremulous body, or air. But a simple reflection of the sonorous air is not enough to explain the echo; for then every plain surface of a solid hard body, as being fit to reflect a voice or sound, would redouble it, which we find does not hold. In order to produce an echo, therefore, it should seem that a kind of concameration or vaulting is necessary, in order to collect, and by collecting to heighten and increase, and afterwards reflect, the sound, as we find is the case in reflecting the rays of light, where a concave mirror is required. In effect, as often as a sound strikes perpendicularly on a wall, behind which is any thing of a vault or arch, or even another parallel wall, so often will it be reverberated in the same line, or other adjacent ones. For an echo to be heard, therefore, it is necessary that the ear should be in the line of reflection; for the person who made the sound to hear its echo, it is necessary that he should be perpendicular to the place which reflects it; and for a manifold or tautological echo, it is necessary that there should be a number of walls, and vaults or cavities, either placed behind or fronting each other. A single arch or concavity can scarcely ever stop and reflect all the sound; but if there be a convenient disposition behind it, part of the sound propagated thither, being collected and reflected as before, will return another echo; or if there be another concavity, opposed at a due distance to the former, the sound reflected from the one upon the other will be tossed back again by the latter.

Echoes may be produced in circumstances wholly different. For, first, a *plane* obstacle reflects back the sound in its due tone and loudness, allowance being made for the

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proportionable decrease of the sound, according to its distance; secondly, a *convex* obstacle reflects the sound somewhat smaller and somewhat quicker, though weaker, than otherwise it would be; and, thirdly, a *concave* obstacle echoes back the sound larger, slower, and also inverted, but never according to the order of words. Nor does it seem possible to contrive any single echo that shall invert the sound, and repeat backwards; because, in such a case, the word last spoken, that is, which last occurs to the obstacle, must be repelled first, which cannot be. For where in the mean time should the first words hang and be concealed; or how, after such a pause, could they be revived and animated again into motion? From the determinate concavity or arching of the reflecting bodies, it may happen that some of them shall only echo back one determinate note, and only from one place. Fourthly, the echoing body being removed farther off, it reflects more of the sound than when nearer, which is the reason why some echoes repeat but one syllable, some one word, and some many. Fifthly, echoing bodies may be so contrived and placed, that by reflecting the sound from one to the other, either directly and mutually, or obliquely and by succession, out of one sound, a multiple echo or many echoes shall arise. Add to this, that a multiple echo may be made, by so placing the echoing bodies at unequal distances, that they may reflect all one way, and not one on the other. By this means a manifold successive sound will be heard, one clap of the hands like many, one *ha* continued like laughter, one single word like many of the same tone and accent, and one viol like many of the same kind imitating each other. Lastly, echoing bodies may be so arranged that from any one given sound they shall produce many echoes different both as to tone and intention. By this means a musical room may be so contrived that one instrument playing therein shall not only seem as many of the same sort and size, but even as a concert of different ones; which is effected by placing certain echoing bodies so that any note placed shall be returned by them in thirds, fifths, and eighths.

ECHO is also used for the place where the repetition of the sound is produced or heard.

Echoes are distinguished into different kinds. *Single echoes* are those which return the voice but once. Of these some are *tonical*, which only return a voice when modulated into some particular musical tone; and others, *polysyllabical*, which return many syllables, words, and sentences. *Multiple* or *tautological* echoes are those which return syllables and words the same oftentimes repeated.

In echoes, the place where the speaker stands is called the *centrum phonicum*, and the object or place that returns the voice the *centrum phonocampticum*.

At the sepulchre of Metella, wife of Crassus, there was an echo, which repeated what was said five times. Authors mention a tower at Cyzicus, where the echo repeated seven times. One of the finest echoes we read of is that mentioned by Barthius, in his notes on the *Thebais* of Statius (lib. vi. 30), which repeated the words uttered seventeen times; it was situated on the banks of the Naha, between Coblentz and Bingen. Barthius assures us that he had proved what he writes, and had counted seventeen repetitions.

ECHO, in *Architecture*, a term applied to certain kinds of vaults and arches, most commonly of the elliptic and parabolic figures, used to redouble sounds, and produce artificial echoes.

ECHO, in *Poetry*, a kind of composition in which the last words or syllables of each verse contain some meaning, which, being repeated apart, answers to some question or other matter contained in the verse. Thus, in the line of Virgil:

Crudelis mater magis, an puer improbus ille?
Improbus ille puer, crudelis tu quoque mater.

Echometer

Eclectics.

ECHO, in fabulous history, a daughter of the Air and Tellus, who chiefly resided in the vicinity of the Cephissus. She was once an attendant of Juno's, and became the confidant of Jupiter's amours. Her loquacity, however, displeased Jupiter, and she was deprived of the power of speech by Juno, and only permitted to answer to the questions which were put to her. Pan had formerly been one of her admirers, but he never enjoyed her favours. Echo, after she had been punished by Juno, fell in love with Narcissus; but being despised by him, pined away, having nothing left but her disembodied voice.

ECHOMETER, among musicians, a kind of scale or rule, with several lines on it, serving to measure the duration and length of sounds, and to determine their intervals and ratios.

ECIJA, a city of Spain, in that division of Andalusia denominated the kingdom of Seville. It is situated on the right bank of the river Xenil, which is here crossed by a neat bridge of modern erection. The surrounding country suffers much from a scarcity of water; but when the summer happens to be rainy, it is abundantly productive in grain of every kind, and in wine, and feeds considerable herds of cattle. It was a considerable city when the Romans ruled the peninsula, and was then called Astigi. Many inscriptions of ancient date are found in the city and its vicinity. It contains six churches, sixteen monasteries, fifteen hospitals, 6000 houses, and 28,176 inhabitants. There are some tanneries here, and a trade in leather is carried on. Cotton is grown in the surrounding country. It is thirty miles from Cordoba. Long. 4. 34. 19. W. Lat. 37. 31. 51. N.

ECKIUS, or ECHIUS, JOHN, an eminent and learned controversialist, professor in the university at Ingolstadt, and remarkable for the opposition he gave to Luther, Melancthon, Carlostadius, and other leading Protestants in Germany, was born in Suabia in 1486. He wrote many polemical tracts; and amongst the rest a *Manual of Controversies*, printed in 1535, in which he discourses upon most of the heads contested between the Protestants and Roman Catholics. He also wrote a Commentary on Selingstadt, 1536, *Homilies*, &c.; and died in 1543.

ECLECTICS (*eclectici*), a name given to some ancient philosophers, who, without attaching themselves to any particular sect, took whatever they judged good and solid from each; and hence their denomination. Laertius observes that they were also, for the same reason, denominated *analogetici*; but that they call themselves *philalethes*, or lovers of truth. The chief or founder of the eclectics was Potamon of Alexandria, who lived under Augustus and Tiberius, and who, weary of doubting of all things with the Sceptics and Pyrrhonists, formed the eclectic sect, called by Vossius the elective.

Towards the close of the second century, a sect arose in the Christian church under the denomination of Eclectics, or modern Platonists, professing to make truth the only object of their inquiry, and to be ready to adopt from all the different systems and sects such tenets as they thought agreeable to it. However, they preferred Plato to the other philosophers, and looked upon his opinions concerning God, the human soul, and things invisible, as conformable to the spirit and genius of the Christian doctrine. One of the principal patrons of this system was Ammonius Saccas, who laid the foundation of that sect afterwards distinguished by the name of the New Platonists in the Alexandrian school.

ECLECTICS were also a certain sect of physicians among the ancients, of whom Archigenes, who lived under Trajan, was the chief, and selected from the opinions of all

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the other sects those which appeared to be best and most rational. Hence they are called *eclectics*, and their prescriptions *medicina eclecticica*.

ECLIPSE, in *Astronomy*, the deprivation of the light of the sun, or of some heavenly body, by the interposition of another heavenly body between us and that body. See **ASTRONOMY**.

ECLIPSE ISLANDS, a cluster of small rocky barren islands in the South Pacific Ocean, near the south-west coast of New Holland.

ECLIPTIC, in *Astronomy*, a great circle of the sphere, supposed to be drawn through the middle of the zodiac, making an angle with the equinoctial of about $23^{\circ} 30'$, which is the sun's greatest declination; or, more strictly speaking, it is that path or way among the fixed stars, which the earth appears to describe to an eye placed in the sun. (See **ASTRONOMY**.) Some call it *via solis*, or the way of the sun, because the sun in his apparent annual motion never deviates from it, as all the other planets do more or less.

ECLIPTIC, in *Geography*, a great circle on the terrestrial globe, not only answering to, but falling within, the plane of the celestial ecliptic. See **GEOGRAPHY**.

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ECLODE, a town of Hindustan, in the province of Malwah, belonging to the predatory chieftain Meer Khan. Long. $77. 55$. E. Lat. $24. 5$. N.

ECLOGUE, in *Poetry*, a kind of pastoral composition, in which shepherds are introduced conversing together. The word is formed from the Greek *εκλογη* choice; so that, according to the etymology, eclogue should be a select or choice piece; but custom has assigned to it a further signification, namely, a little elegant composition in a simple, natural style and manner.

Idyllion and eclogue, in their primary sense, are the same. Thus the *idyllia*, *ιδυλλια*, of Theocritus, are pieces written perfectly in the same vein with the *eclogæ* of Virgil. But custom has made a difference between them, and appropriated the name of *eclogue* to pieces in which shepherds are introduced speaking; and *idyllion* to those written, like the eclogue, in a simple, natural style, but without any pastoral interlocutors.

Of the Idyl, as the word is generally written, Germany in particular, amongst modern nations, has produced some highly finished specimens. England can boast of comparatively few eclogues so called. Those of Collins are esteemed the best.

ECONOMISTS.

It is not generally known how much the science of politics, that master science, the late offspring of the improved reason of modern times, is indebted to the philosophers who are known to the world by the title of economists. They were, it is true, preceded in this country by Hobbes and by Locke, and in France by Montesquieu; but in analysing the frame of civil society, they added considerable lights to those which had been communicated by their predecessors; and they attempted to point out the mode of combining the various springs of social action in a more liberal and beneficent system than had yet been recommended to the world.

It is worthy of remark, that the merits of this sect, in the secondary department of *political economy*, have so much obscured their important speculations on the great questions respecting the best possible order capable of being given to society, that they are, in this country at least, wholly unknown, except in the character of political economists; though their political economy formed only a small and subordinate branch of their entire system; and, what is indeed extraordinary, we know not a book in the English language in which an account of that system is to be found.

This article is intended to contain, *1st*, the history of the sect; *2dly*, an account of their system; and, *3dly*, some observations, pointing out the principal errors into which they have fallen.

I. M. de Gournay appears to have been the first man in France who had formed any systematic notions on the real principles of trade. It is true, indeed, that Fenelon had recommended, on the direct suggestion of good sense, detached from theory, the practice of freedom of trade. The Marquis d'Argenson was celebrated for the sound and important maxim, *Pas trop gouverner*; and the memorable advice of the merchants to the meddling Colbert was well known, *Laissez-nous faire*. Another of the more peculiar doctrines of the economists was expressed in the famous maxim of the great Duc de Sully, *Que le labourage et le pâturage sont les mamelles de l'état*; and Montesquieu had brightly but superficially run over several of the questions relative to trade.

For such lights as M. de Gournay did not derive from

his own reflections, he seems to have been chiefly indebted to the writers of England; but there appears some reason to conclude that the best of these had not fallen in his way. We do not perceive, for example, any sign of acquaintance with the writings of Locke.

Jean-Claude-Maria Vincent, Seigneur de Gournay, was an extraordinary man for the age and country in which he was produced. He was born at St Malo, in the month of May 1712, the son of Claude Vincent, one of the most considerable merchants of the place. Destined to commerce by his parents, he was sent to Cadiz when scarcely seventeen years of age. His vigilant attention to business did not hinder him from finding time, well husbanded and diligently applied, not only for storing his mind with general knowledge, but for unravelling the combinations of commerce, and ascertaining its elementary principles. After he had raised himself to great eminence as a merchant, and to a high reputation for knowledge of the principles of commerce, the ministers of France conceived the design of turning his knowledge to advantage in the office of intendant of commerce, as they call it, to which he was raised in 1751.

No sooner was M. de Gournay invested with his office, than he began to wage war with the established system of regulations and restrictions, which the experience of twenty years of mercantile practice the most varied and the most extensive, discussions with the most intelligent merchants of Holland and of England, the perusal of the best writers on the subject, and the impartial application of his own philosophical thoughts, had all conspired to make him regard as a source, not of national advantage, but of continual vexation and hardship to individuals, and of poverty to the state. "He was astonished," says M. Turgot, "to find that a citizen could neither make nor sell a commodity, without having purchased a privilege, by getting himself made, at a great expense, a member of some corporation; that if he made a piece of cloth, for example, of any quantity and quality different from those commanded in certain regulations, instead of being allowed to sell it to those purchasers whom such quantity and quality suited the best, he should be condemned to see it cut in pieces, and to pay a fine heavy enough to reduce a whole family to beggary. He could not conceive

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how, in a country where the succession to titles, to estates, and even to the crown itself, rested upon custom, and where the application of even the punishment of death was rarely guided by any written definitions, the government should have thought proper to fix by written laws the length and breadth of each piece of cloth, and the number of threads which it ought to contain. He was not less astonished to see the government take in hand to regulate the supply of commodities; proscribe one sort of industry in order to make another flourish; shackle with peculiar restrictions the sale of the most necessary articles of subsistence; prohibit the storing of commodities, of which the quantity produced varies greatly from year to year, while the quantity required for consumption is pretty nearly the same; restrain the export and import of a commodity subject to the greatest fluctuation of price; and dream of insuring the plentiful supply of corn by rendering the condition of the labourer more uncertain and more wretched than that of any other part of the community." (*Œuvres de M. Turgot*, iii. 333.)

It may easily be imagined that M. de Gournay would find himself encountered by opposition the moment he endeavoured to introduce his beneficial views into practice. The grand instruments of this opposition were certain words and phrases, which have been used to screen misrule in every country in which the voice of reform has begun to be raised. "M. de Gournay," says Turgot, "was opposed, under the names of an 'innovator' and a 'theorist,' for endeavouring to develop the principles which experience had taught him, and which he found universally recognised by the most enlightened merchants of every part of the world among whom he had lived. The principles marked out for reprobation, under the title of the 'new system,' appeared to him to be exactly the principles of plain good sense. The whole of this system was founded upon the certain maxim, that, in general, each man is a better judge of his own interest, than another man to whom it is a matter of indifference. From this M. de Gournay concluded, that, when the interest of individuals is precisely the same with the general interest, the best thing to be done is, to leave every man at liberty to do what he likes. Now he held it as impossible, that in commerce, fairly left to itself, the interest of the individual should not coincide with the interest of the community." The proof which M. Turgot gives of the fundamental proposition, that the interest of the individual and of the community in a free commerce are the same, we need not repeat; because it can neither be rendered more clear nor more cogent than it is already in works with which every person is familiar, who is at all conversant with political science.

"From this principle M. de Gournay concluded, that the sole duties of government with regard to commerce are: 1. To render to all the branches of industry that precious liberty, of which the prejudices of barbarous times, the proneness of governments to lend themselves to the gratification of individual interests, and the pursuit of a mistaken good, have conspired to deprive them: 2. To facilitate the exercise of industry and ingenuity to every member of the community, exciting thereby the greatest competition among sellers, and ensuring the greatest perfection and cheapness of the commodities sold: 3. To admit the greatest competition among buyers, by opening to the seller every possible market; the sole means of encouraging reproduction, which hence derives its only reward: 4. To remove every obstacle by which the progress of industry is retarded, by depriving it of its natural reward."

It is to M. de Gournay, therefore, that Turgot ascribes the origin of political economy in France. "It is to the

ardour," says he, "with which M. de Gournay endeavoured to direct to the study of commerce and of political economy, all the talent which he was able to discover, and to the facility with which he communicated the lights which he himself had acquired, that we ought to ascribe the happy fermentation which for some years has been excited on these important subjects; a fermentation which arose two or three years after M. de Gournay was intendant of commerce, and has since that time procured us several works calculated to wipe off from our nation that reproach of frivolity, which, by its indifference for the more useful studies, it had but too justly incurred."

Francis Quesnay was born in the village of Ecqueville in the year 1694. According to M. Dupont de Nemours, the editor and commentator of the works of Turgot, and a zealous economist, he was the son of a small proprietor, who cultivated his own little property; and he was eminently indebted to his mother for the fashion of his mind. Though he was educated as a physician, and rose to such eminence in his profession as to be first physician to the king, the early occupation of his mind on the business of agriculture had given the current of his thoughts a permanent direction; and when he was summoned to reflect on the sources of wealth, by the discussions probably to which the speculations of M. de Gournay had given birth, agriculture was the object on which his attention was more particularly fixed. He produced several works on different points of the science and practice of medicine; and it was only at a late period of life that his works on political economy appeared. His chief production on this subject, *Physiocratie, ou du Gouvernement le plus avantageux au genre humain*, was first published in 1768. Not only had the speculations which he broached, and which he propagated with much fervour and diligence, considerable success in the world, but he had the fortune to gain a considerable number of proselytes, who exerted themselves with an ardour for the diffusion of his doctrine, and with a devotion to the opinions of their master, which more resembled the enthusiasm of the votaries of a new religion, or that of the followers of some of the ancient philosophers, than the indifference with which new speculations in philosophy have on all other occasions been received in modern Europe; and which gave to the economists more of the character of a sect or a school, than has appeared to belong to those who have in recent times concurred in any other system of philosophical opinion.

There was, in truth, in the system of M. Quesnay and the other economists, many things well calculated to attract attention and excite enthusiasm. From a few simple principles, they deduced, as they imagined, by a chain of very close and imposing arguments, a system of changes which would easily be introduced, without the smallest interruption to the tranquillity and happiness of the existing generation, calculated to remove from society all the deformities by which it was overspread, and to communicate to the mass of human beings a fulness of happiness hitherto altogether unknown. At this point, therefore, we may close the historical part of this article; for the success of the great work of Dr Adam Smith, in a short time, superseded the *political economy* of the sect; and after the political economy was discredited, the rest of their doctrines met with little regard. The memory of them, however, is well worthy of being preserved; and this task we shall now, in as few words as possible, endeavour to perform.

II. The economists proceeded upon no Utopian plan, which supposes society to be composed of beings different from those with whom we are already acquainted. They took man as he is, a being having wants, and governed by the desire of avoiding pain and obtaining pleasure.

Econo-
mists.

Man must have subsistence. Upon this ground they first took their stand. This being allowed, it followed, of course, that whatever was the best means of obtaining subsistence, would command the operations of men as soon as ever it was sufficiently known.

Of these means, the first and fundamental is the establishment of property. This they proved by convincing arguments. We cannot exist without consuming. The nature of man leads to a rapid multiplication of human beings, and the earth yields a spontaneous nourishment for only a few. To make food keep pace with population, labour must be employed upon the ground. Men would be born for no other purpose than that of destroying one another, if there were not means of increasing the quantity of food in proportion to those that were born. Labour, then, is one of the physical necessities of nature. But if labour be necessary, so is property, because, without property, there can be no labour.

The proof of this proposition is short and irresistible. Nobody would labour under an assurance that he would derive no advantage from his labour. Nobody would labour without a certain probability that he should enjoy the fruits of his labour. Now, this is property. The only question, then, which remains is, what is the degree of assurance with respect to the fruits of a man's labour; in other words, what are the laws of property which tend most to secure the benefits which human beings derive from their labour? This, said the economists, is the object and the end of our researches.

They proceeded in their inquiry by the following steps. As a means to this labour, on which every thing depends, a man must be free to use his natural faculties of labour—his muscular powers. This freedom they called the *property of his person*. As another means to the same end, he must be free to use exclusively, and to preserve, what he acquires by his labour. This they call his *moveable property*.

Here we see the origin of that to which men have assigned the names of *rights* and *duties*. The exclusive powers assigned to the man over his person, and over the fruits of his labour, are called his *rights*. To allow these exclusive powers, by abstaining from every act which would impair them, is called the *duties* of all other men. Here we see, also, that *rights* and *duties* are reciprocal; that they imply one another, that they are created together, and that the one cannot exist without the other. Destroy the *rights* of property in the man, you destroy, by the same act, the *duties* of other men to exclude themselves from what was called his property. Destroy, in the same manner, the *duties* of other men to exclude themselves from what was called his property, and you destroy, at the same time, his *right* to that exclusion. *Rights* and *duties* are, in fact, but different names given to the same thing, according as it is regarded under one or another of two points of view.

Another important concatenation is here also to be seen. *Rights* are advantages; things to be enjoyed. *Duties* are burthens, abstracted from things to be enjoyed. Why should men accept these burthens, submit to these duties? Why, but because they find their advantage in doing so. It is plain how they find their advantage in doing so, and there is, there can be, no other reason. Men submit to the *duties* of respecting other men's *rights*, that they may have *rights* themselves. It is good for them to have *rights*; there can be no *rights* without *duties*. It is better to have the *rights* submitting to the *duties*, than, by renouncing the *duties*, to have no *rights*. The *duties* are then the price which is paid for the *rights*. The *duties* which one man yields to other men, are the price which he pays for having *rights* of his own. *Duties*, then, are in themselves

evils; and they never ought to exist, except when they are compensated by a greater good. Nobody ought to be subjected to a burthen, which is not, either to himself, or to the community in which he has clubbed his private interests, attended with a good sufficiently great to overbalance the evil which he is made to endure. *Utility*, then, is the exclusive foundation of *duty*.

Having laid this foundation, the economists proceed.

On the necessity of subsistence rests the necessity of property, and on the necessity of property rests the necessity of a certain inequality in the conditions of men. This inequality exists, because a good is obtained through it, which can in no other way be obtained; and that good the parent of every thing else to which the name of good is applied. "Those who complain of it," says Mercier de la Riviere, one of the chief expositors of the doctrines of the sect, "see not that it is a link in the chain by which the human species must drag from the abyss of non-production every thing which they enjoy. As soon as I have acquired the *exclusive* property of a thing, another man cannot have the property of it at the same time. The law of property is the same for all men; each man, however, acquires in proportion to his faculties of acquiring; but the measure of these is different in different men. And besides this fundamental law, there is, in the whirlpool of accidents, a continual succession of combinations, some more, some less fortunate, which increase the causes of that inequality of acquisition, without which the motives to acquisition cannot exist.....I admit, however," he in conclusion adds, "that in any given community, these differences in the possessions of different men may become the source of great disorders, and which augment again these same differences beyond their natural and necessary degree. But what follows from this? That men ought to establish an equality of conditions? Certainly not; for to that end, it would be necessary to destroy all property, and, by consequence, all society: it only follows that they should correct those disorders which make that which is an instrument of good become an instrument of evil; which alters in such a manner the distribution of things, that *force* places all the rights on one side and all the duties on the other."

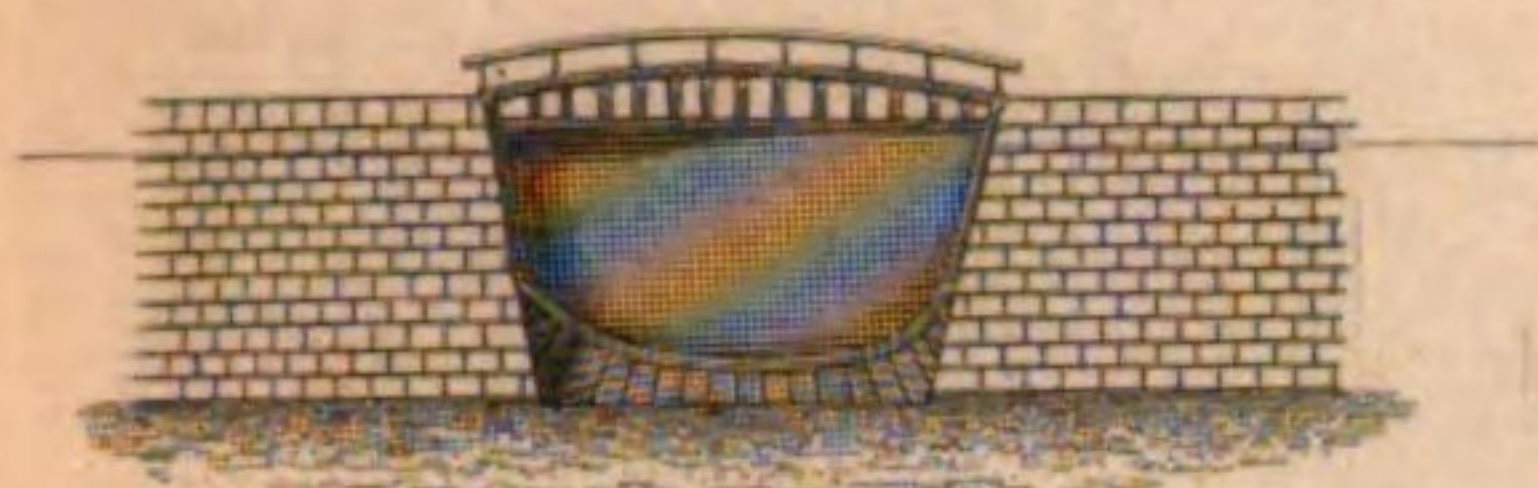
We have seen that the necessity of labour to procure the means of life and the means of enjoyment, produced a necessity of *property personal* and *property moveable*, as the two sorts were named by the economists. The necessity of raising food, as well as the first material of most of the other articles of human enjoyment, by labour upon the *land*, produces a like necessity of creating a *property in the soil*. The proof of this proposition is not less short and convincing than that which regards the other species of property. To make the land yield a produce useful to man, it must be cleared of many incumbrances, and prepared with much labour and expense. No adequate return can be obtained for this labour to the man who would bestow it, without a perpetuity of possession. It is essential for the well-being of the species that the labour should be yielded, and in the greatest degree of perfection. It cannot be yielded perhaps at all, certainly in no tolerable degree of perfection, without that exclusive possession which constitutes property. Property in land is, therefore, essential to the well-being of the human species.

We see in this manner what are the *rights* and what are the *duties* which the supply of the first wants of human nature renders it necessary to constitute; but as all mankind are not disposed to respect *rights* and *duties*, it is necessary, in order to obtain the advantages which they are destined to produce, that measures should be taken to protect them.

The measures taken to protect them are generally com-

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Fig. 1.



PLAN AND ELEVATION OF THE ENTRANCE TO THE DOCK WITH A FLOATING DAM.

Fig. 2.



Fig. 3.

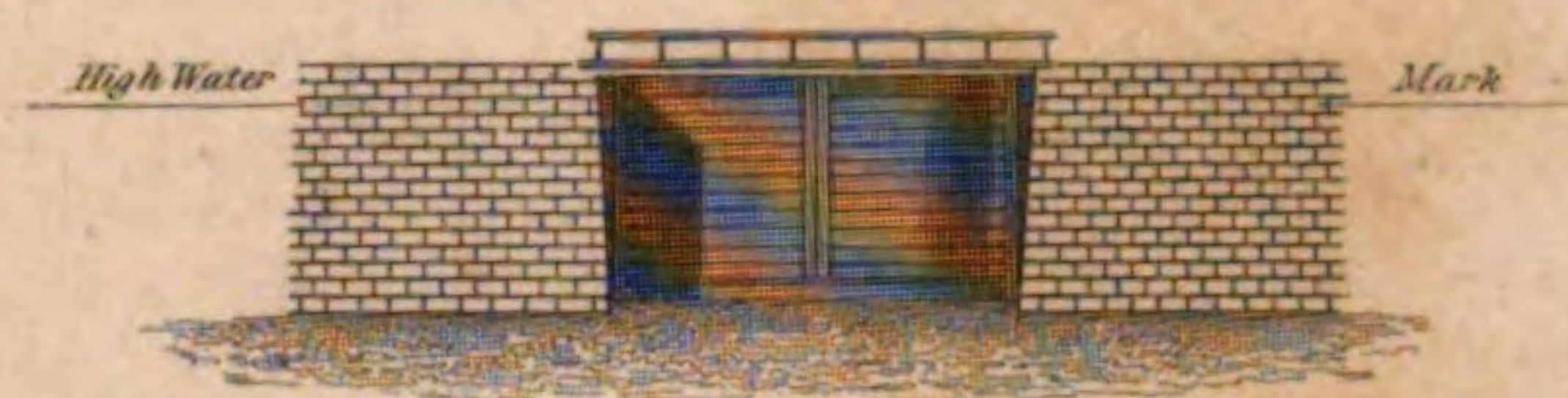
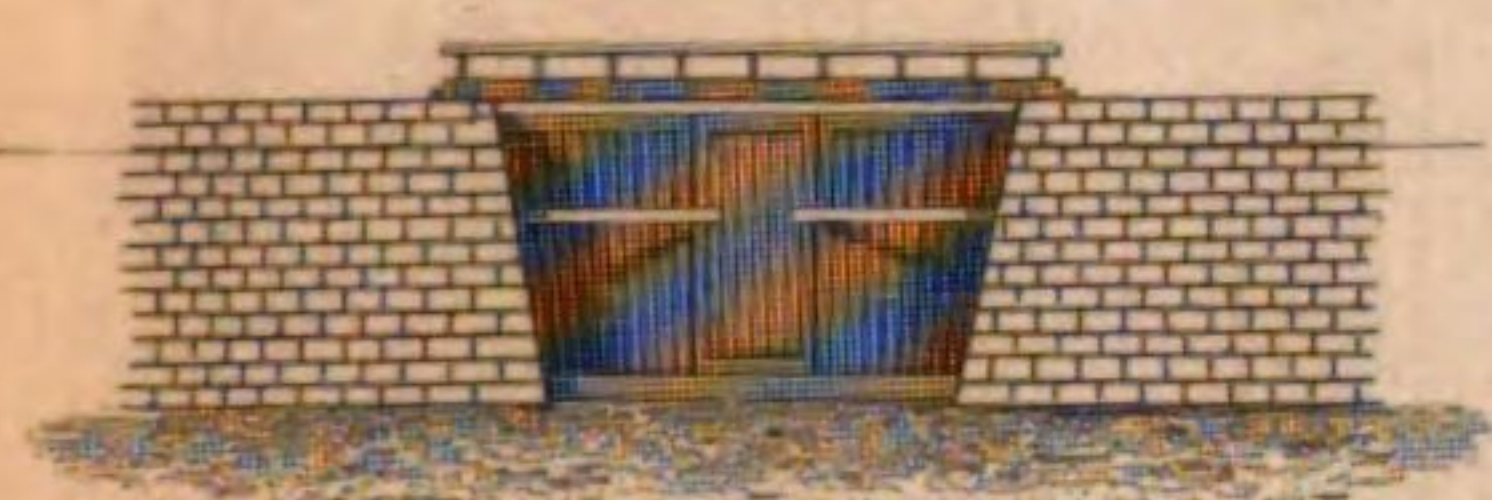
ELEVATION
OF THE ENTRANCE TO THE DOCK WITH SWINGING GATES.

Fig. 5.



PLAN AND ELEVATION OF THE ENTRANCE TO THE DOCK WITH WICKET GATES.

Fig. 6.

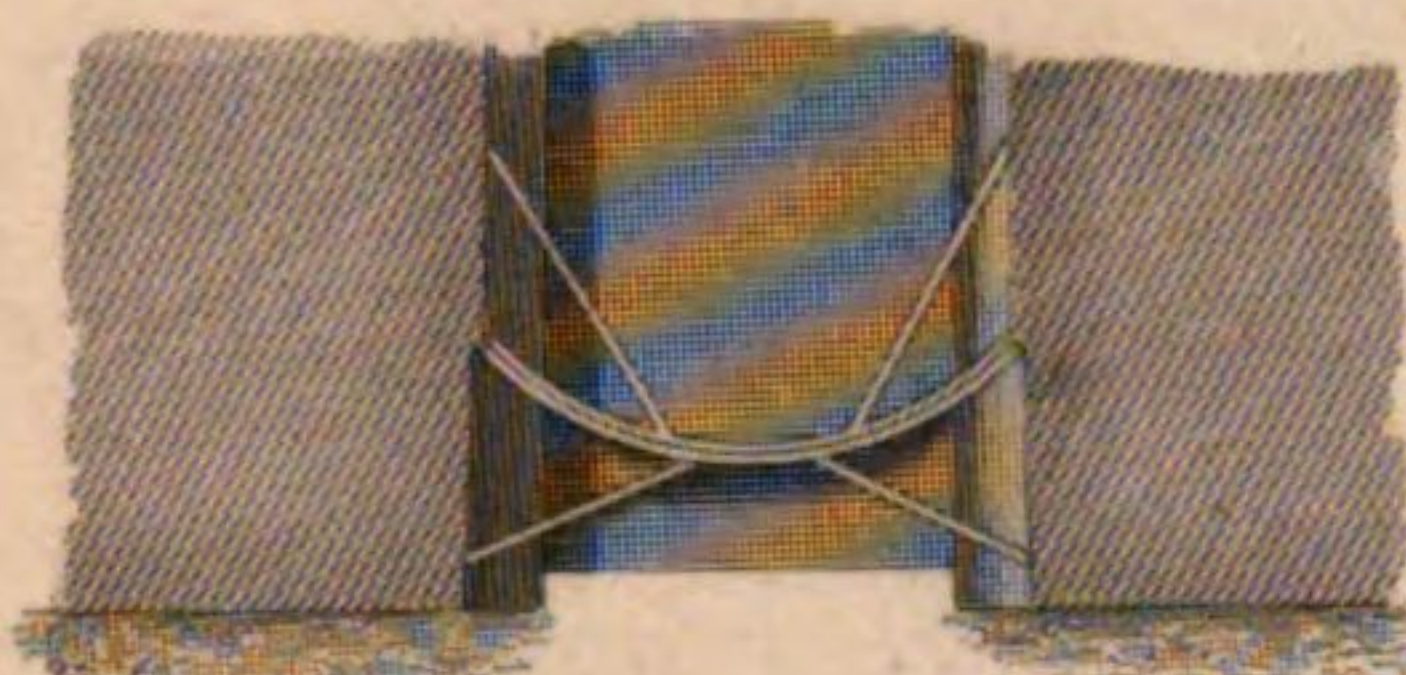
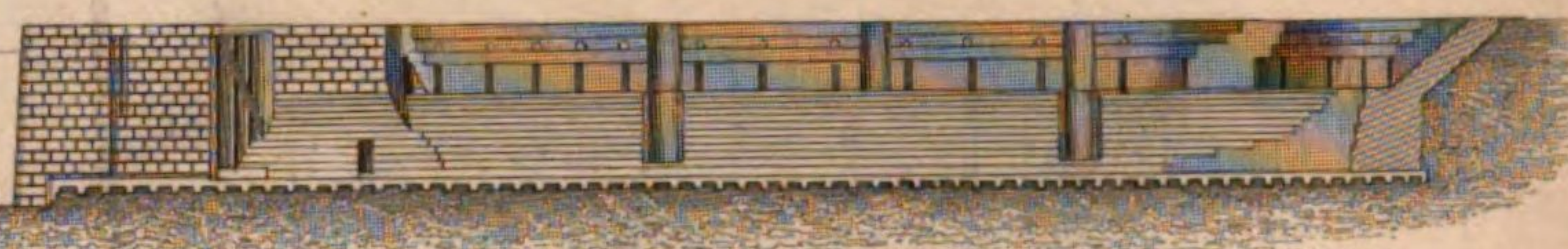


Fig. 4.



SECTIONAL ELEVATION OF THE DOCK.

Fig. 7.

PLAN OF A DOCK.

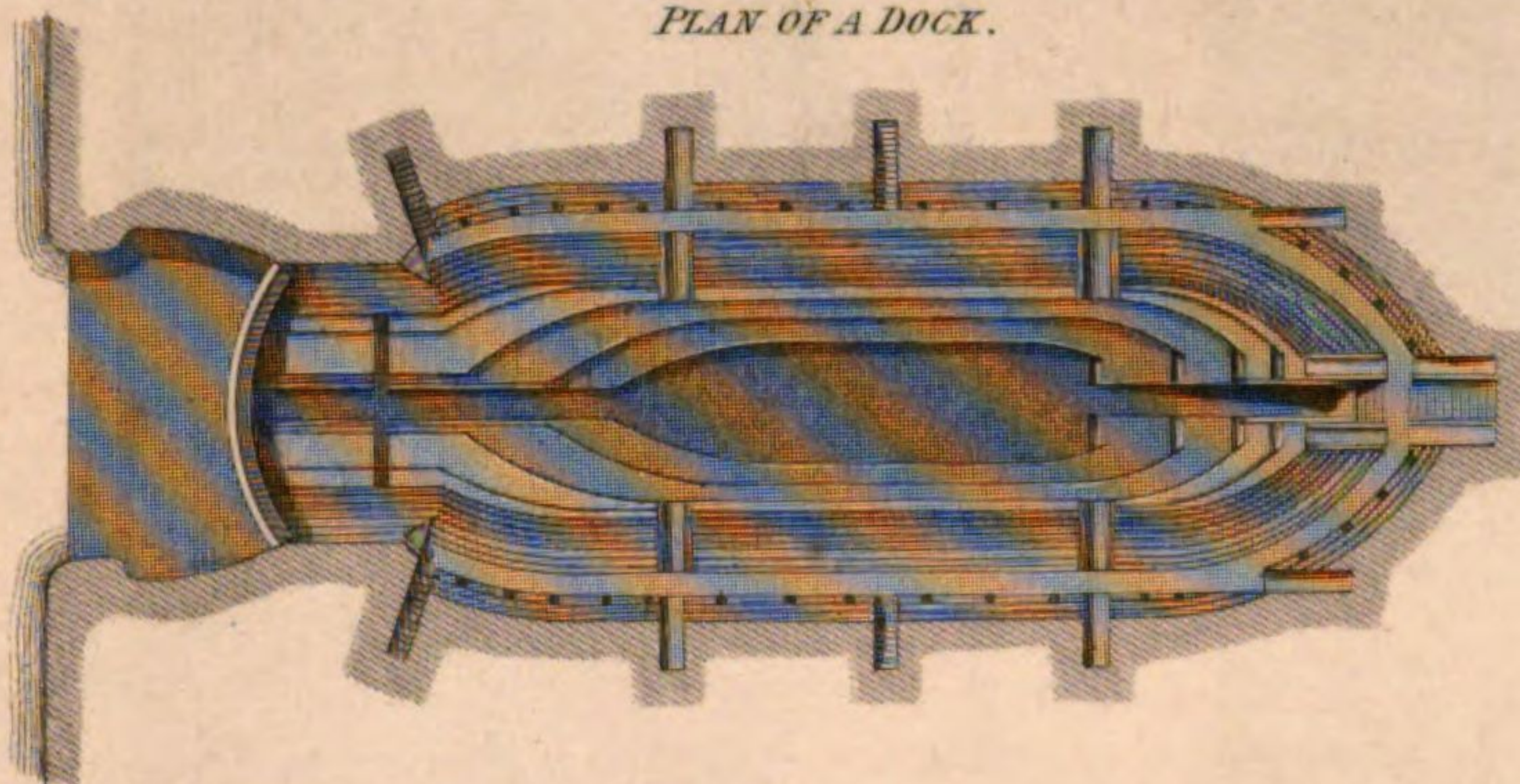
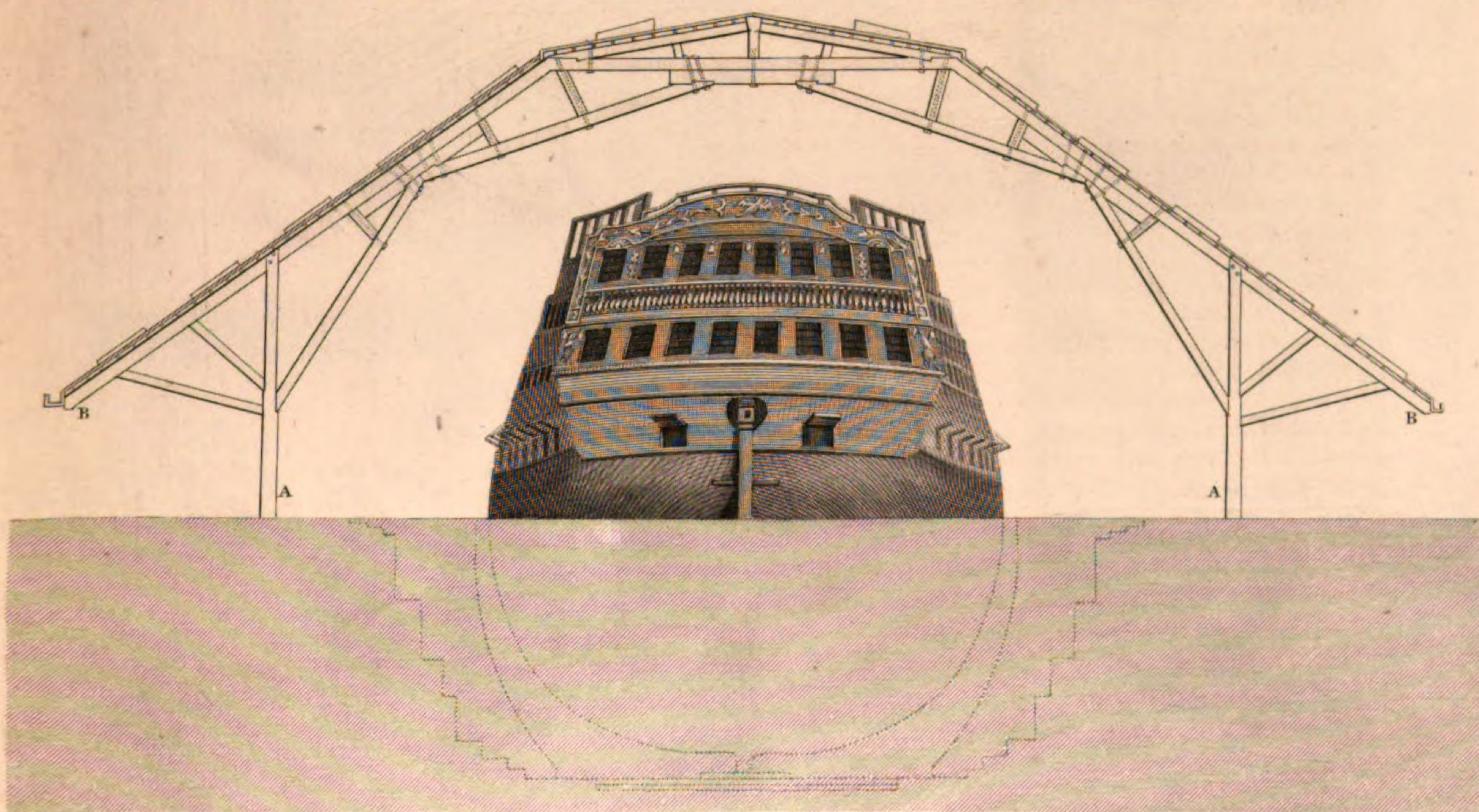


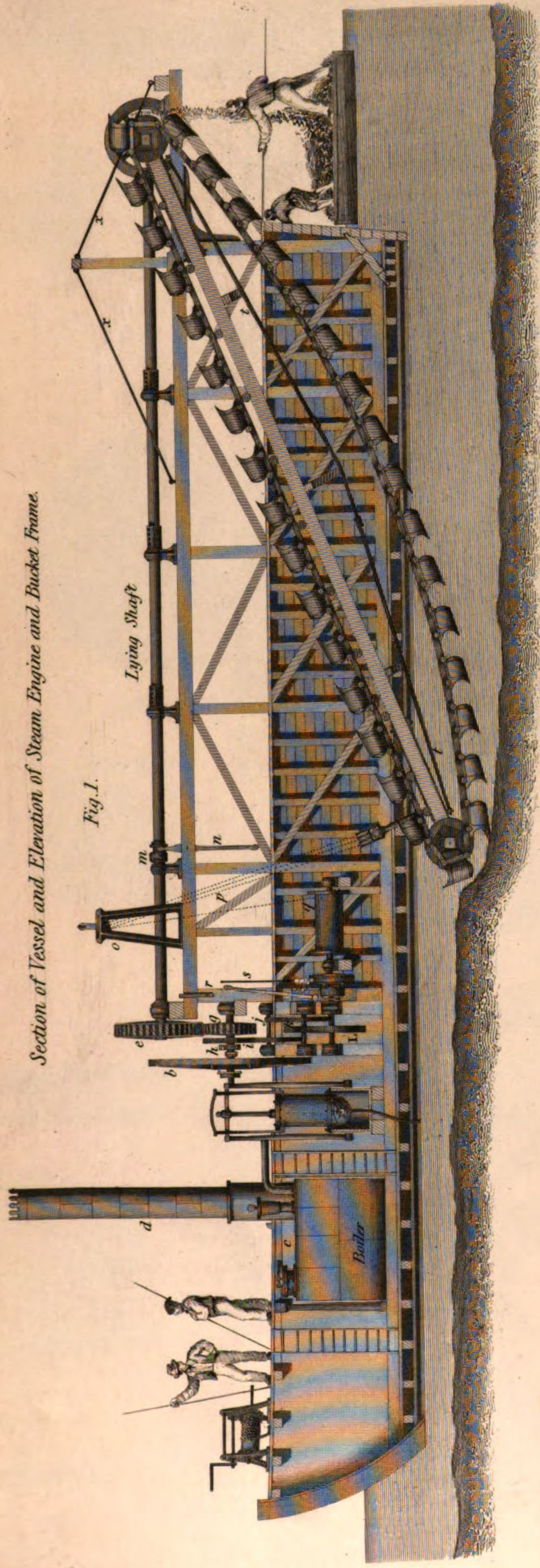
Fig. 8.

TRANSVERSE SECTION OF A ROOF OVER THE HEAD OF THE DOUBLE DOCK AT PLYMOUTH, ERECTED IN 1817. DESIGNED BY SIR R. SEPPINGS, SURVEYOR OF THE NAVY.



DREDGING.

Section of Vessel and Elevation of Steam Engine and Bucket Frame.



Plan.

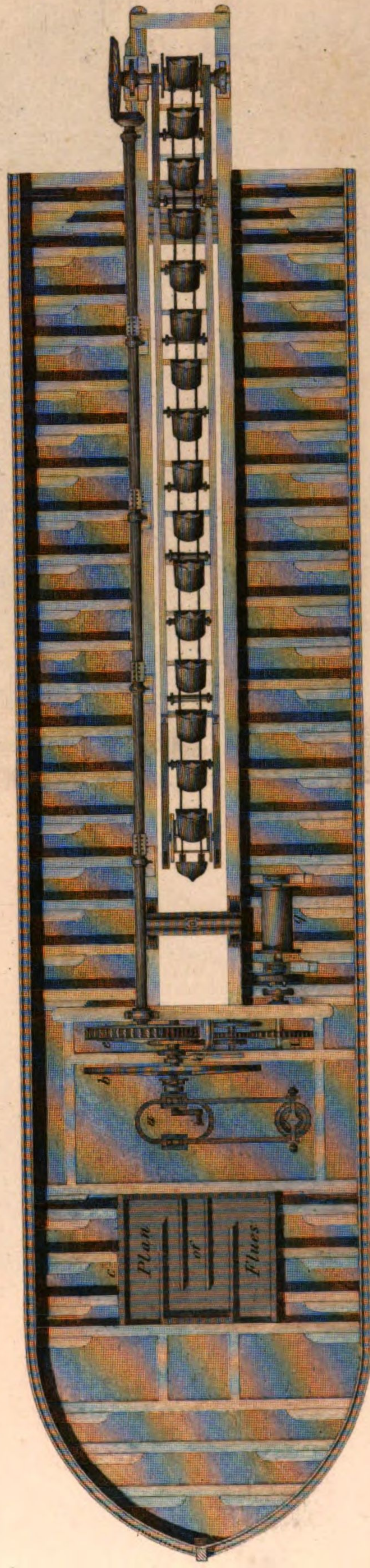


Fig. 2.

A. Slight, Del.

A vertical scale bar with markings at 10, 5, 0, and 20. The markings are on the left side of the bar, and the numbers are oriented vertically. The bar is a simple horizontal line with tick marks at each number.

Fig. 9.

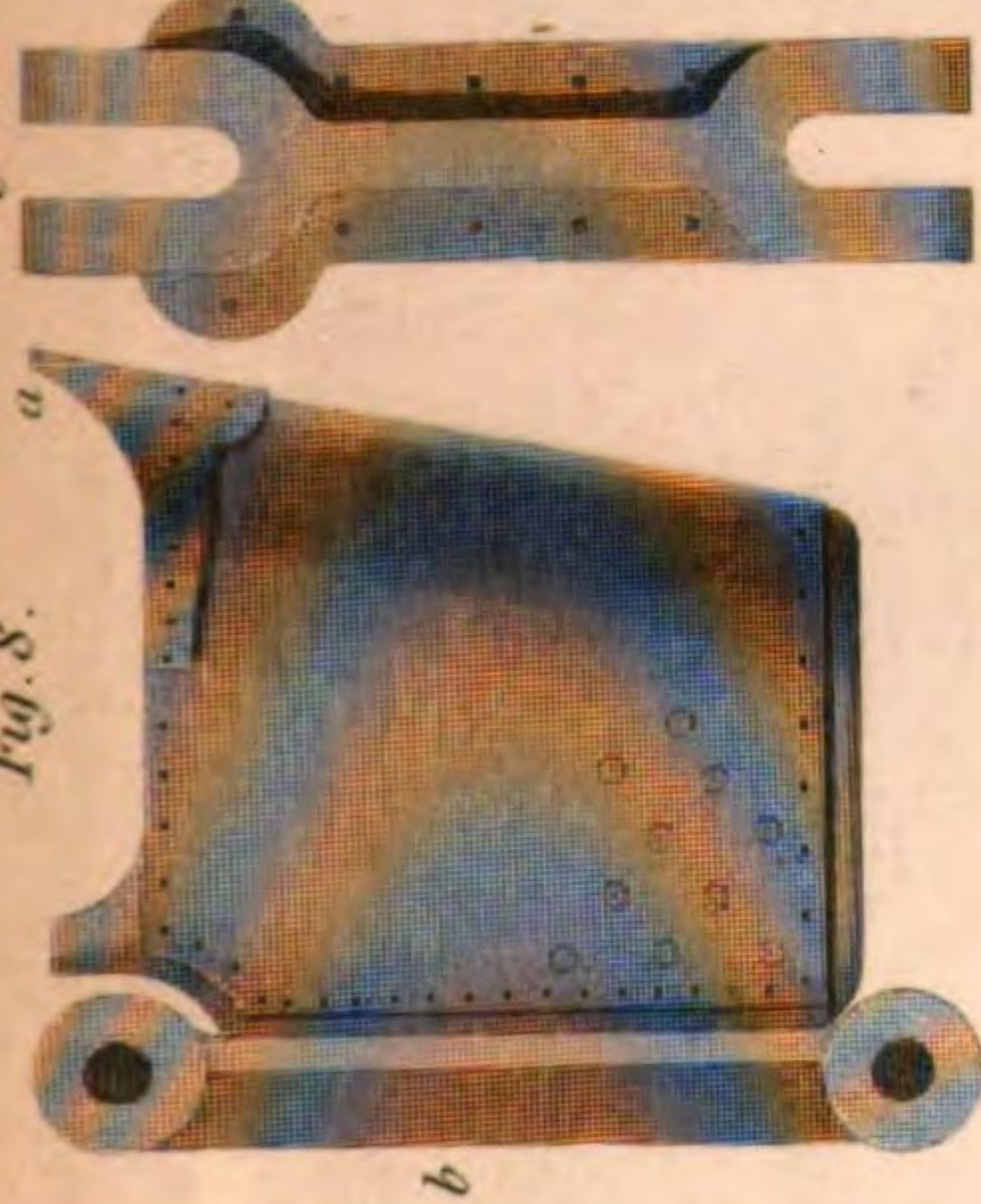


Fig. 8.

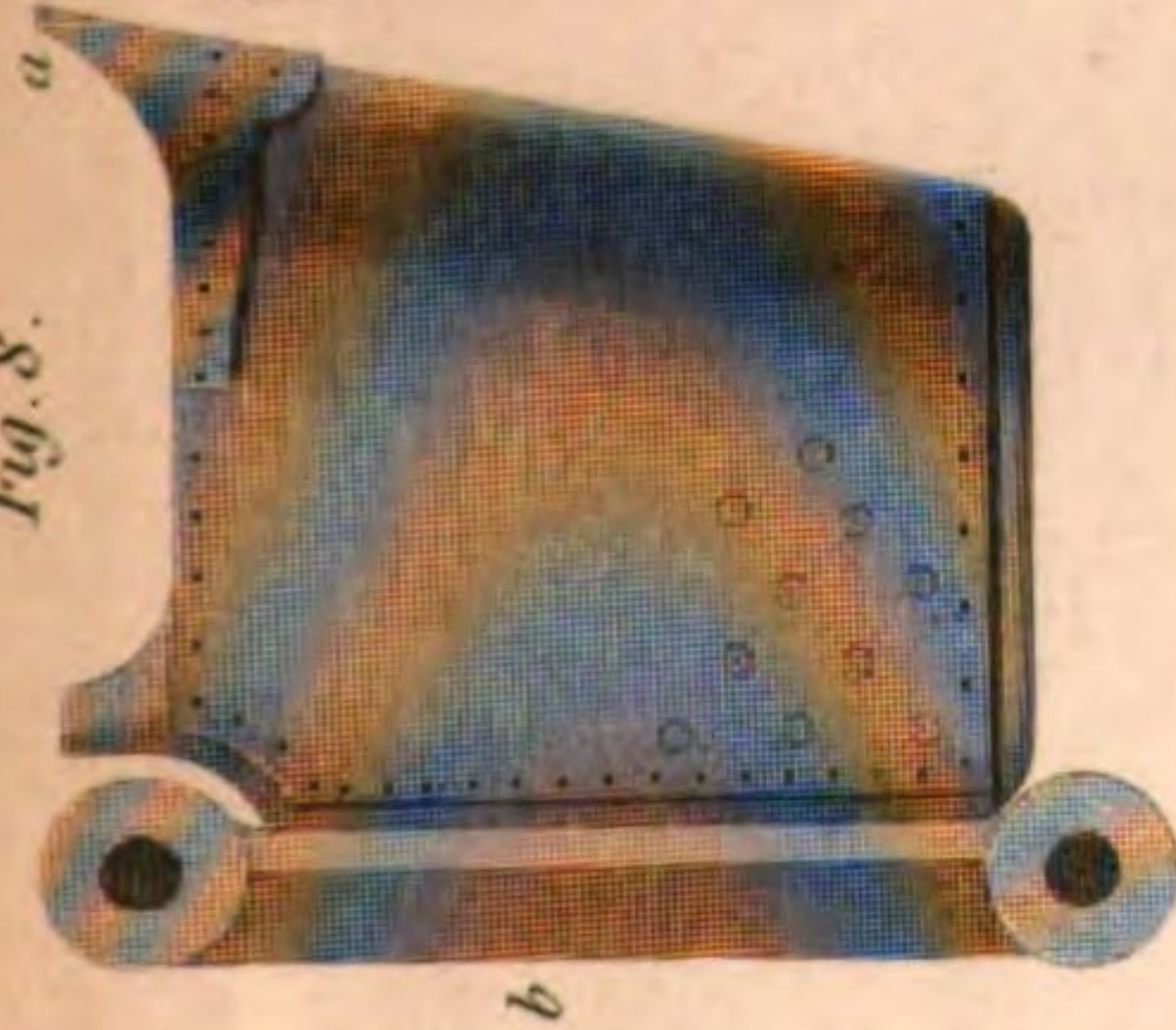


Fig. 2.



Fig. 1.

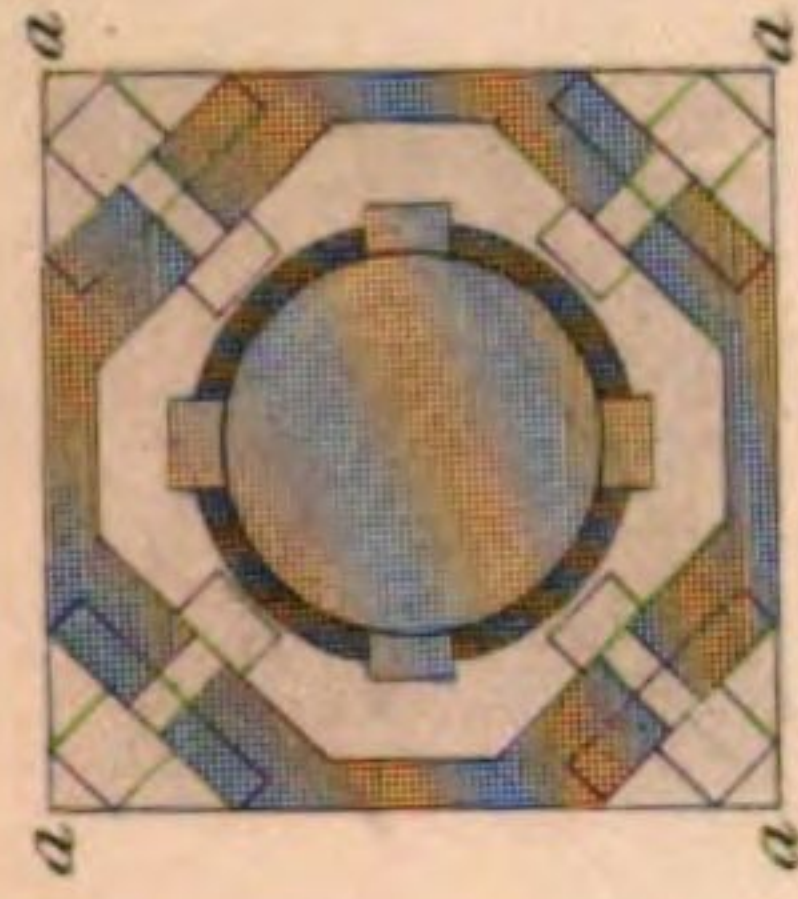


Fig. 11.



Fig. 7.

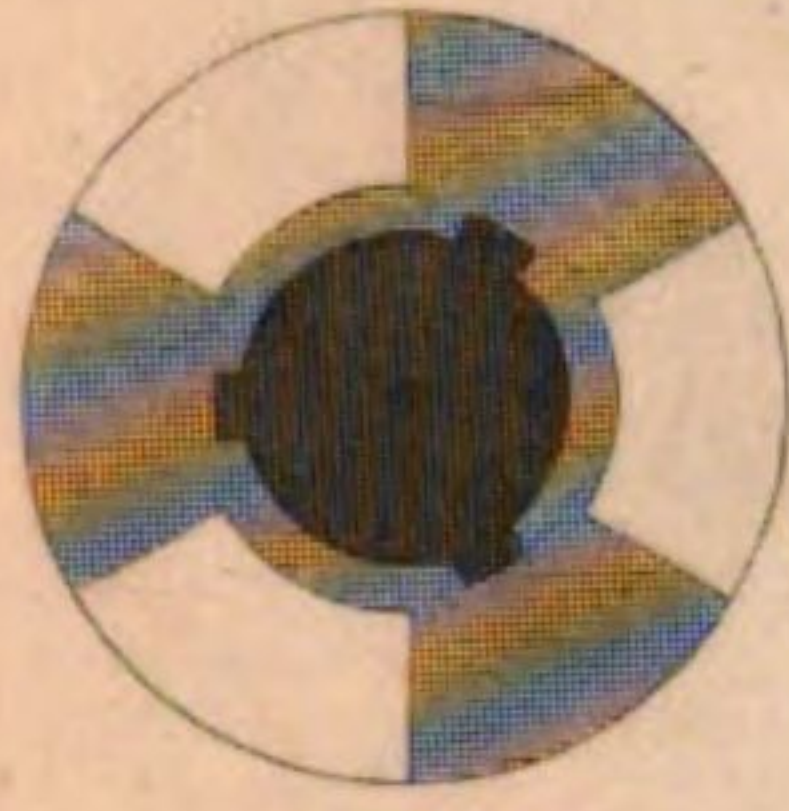
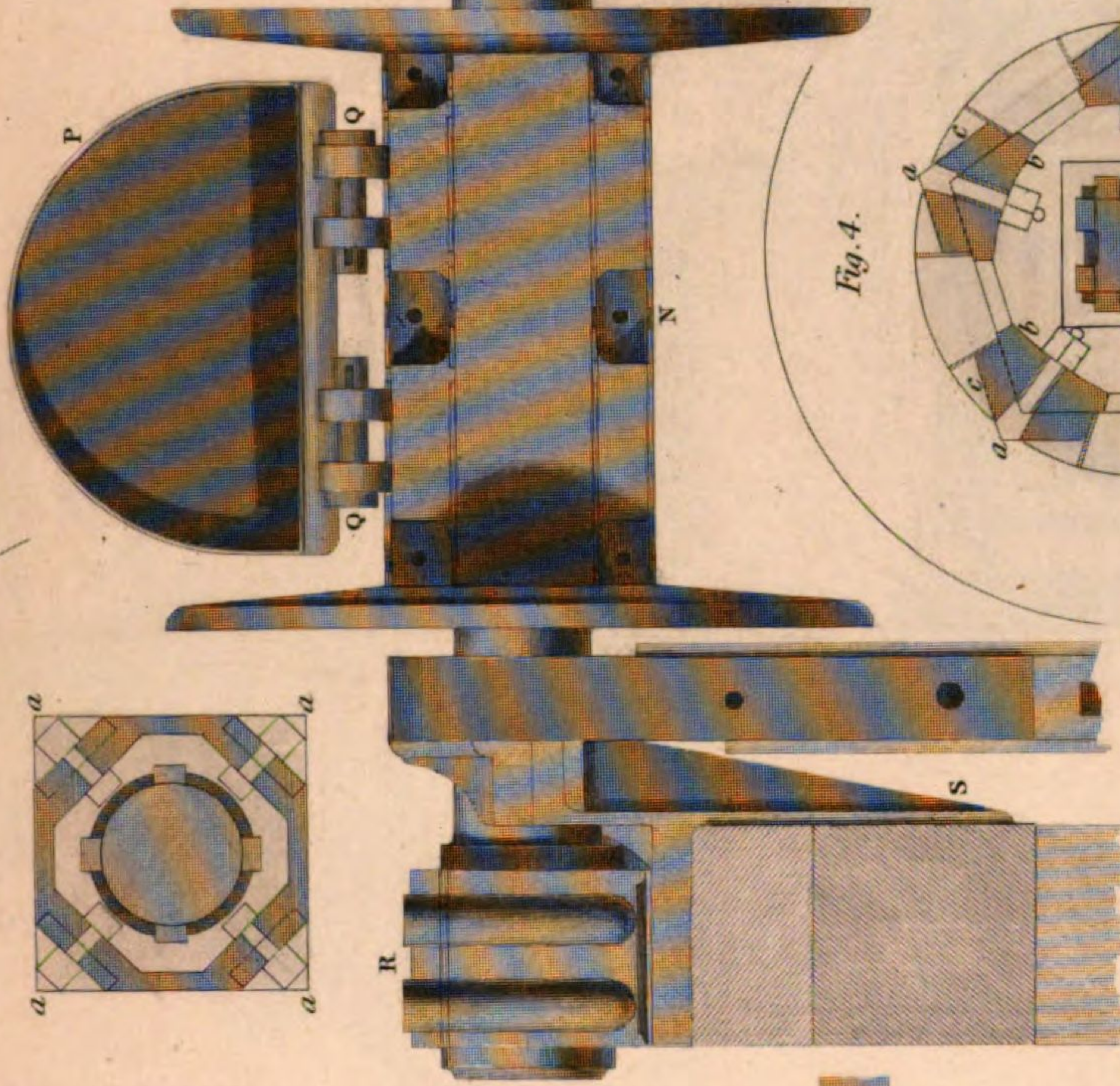


Fig. 5.



Fig. 12.



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Q

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R

S

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Fig. 3.

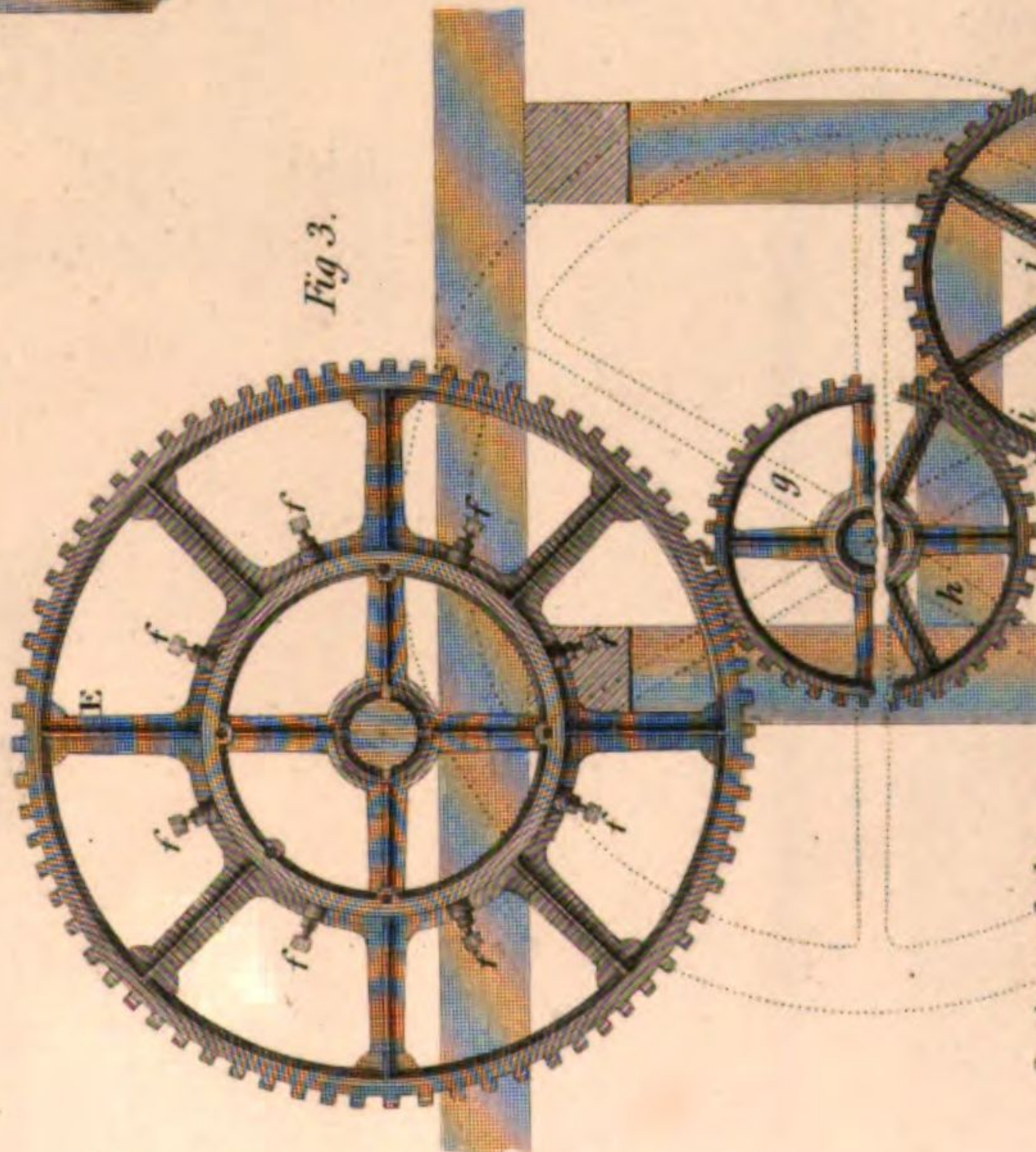


Fig. 10.



Fig. 4.

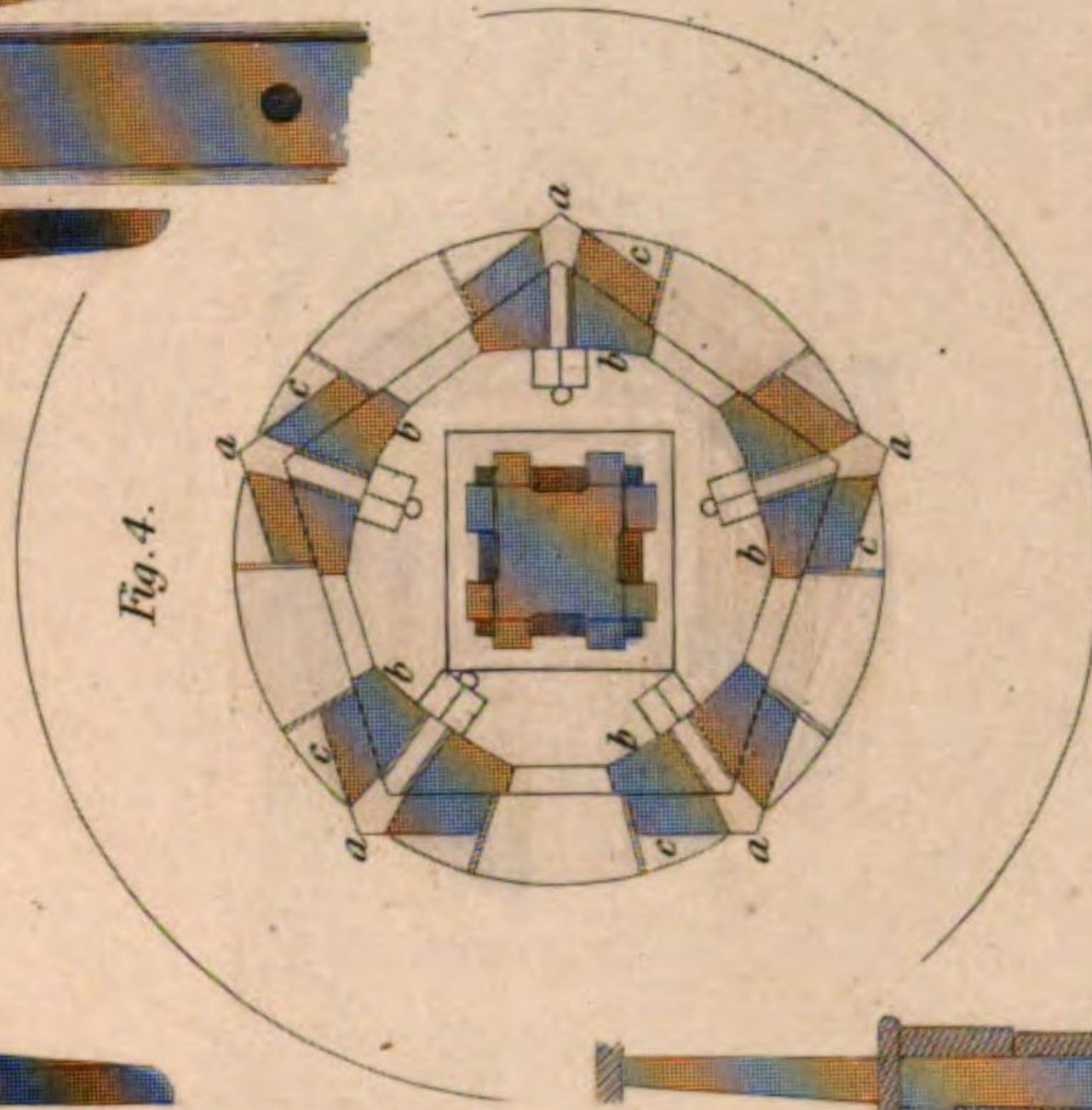


Fig. 6.



Fig. 13.

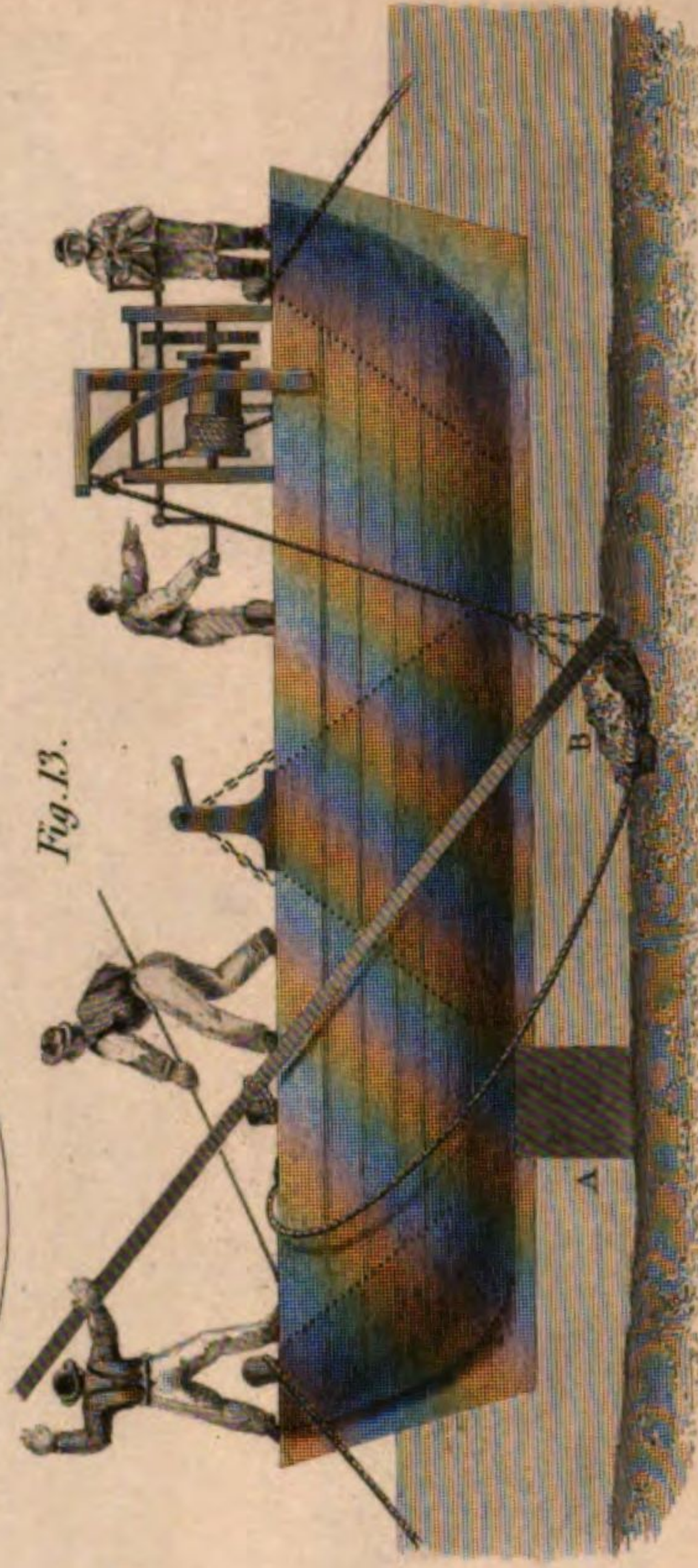


Fig. 1.
Section of Liquor Tub.

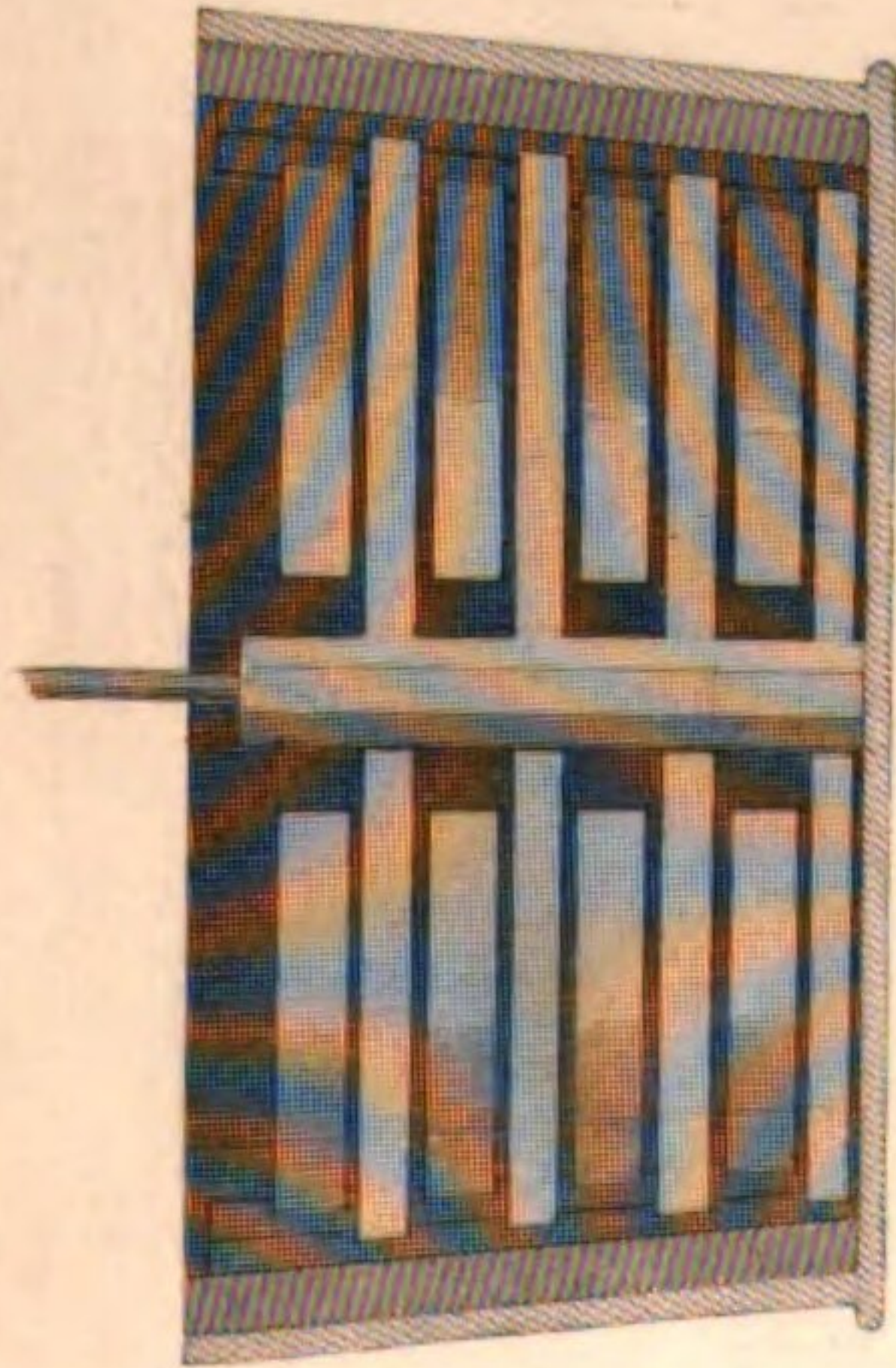


Fig. 3.

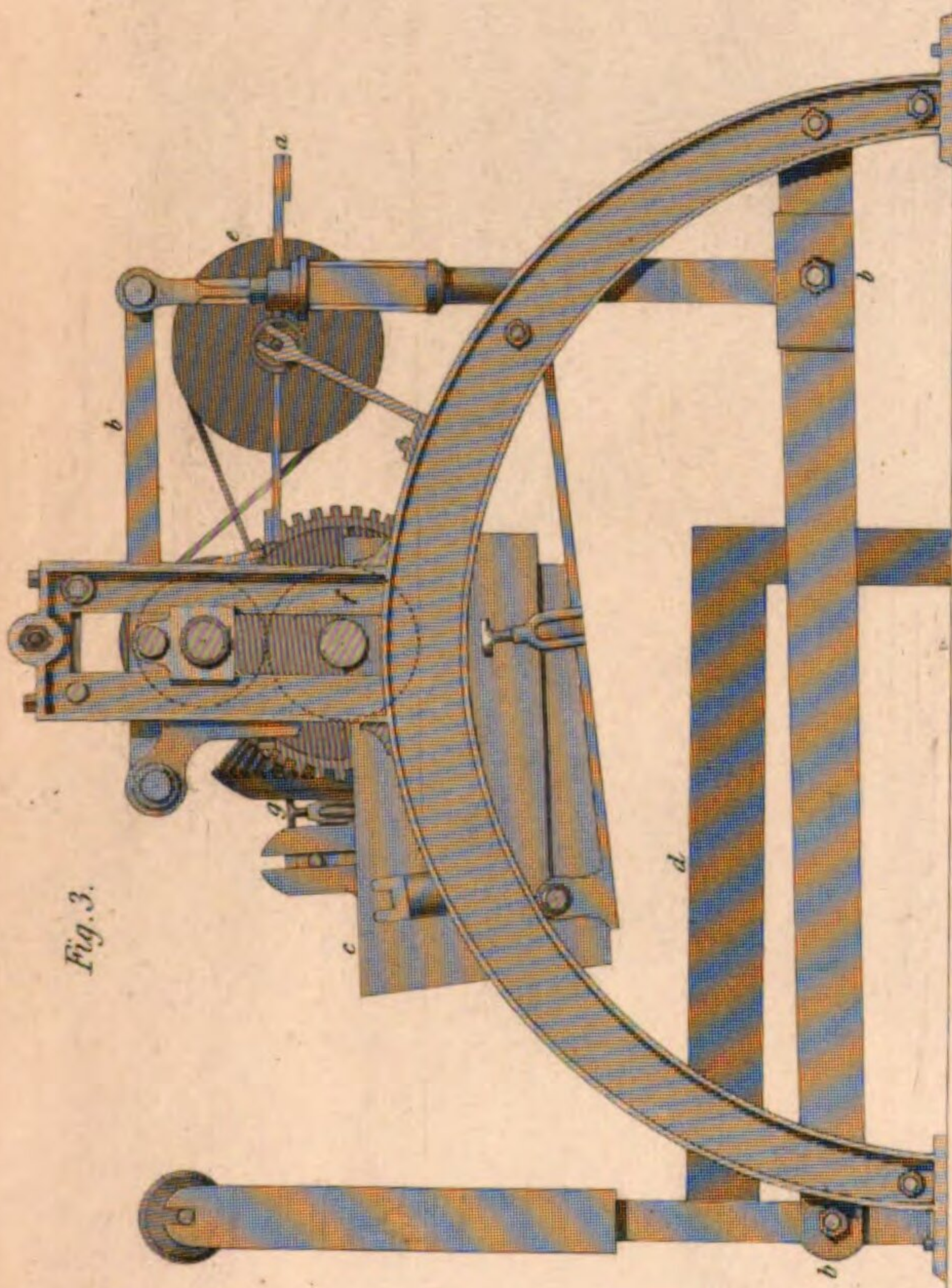


Fig. 2.
Plan of Liquor Tub.

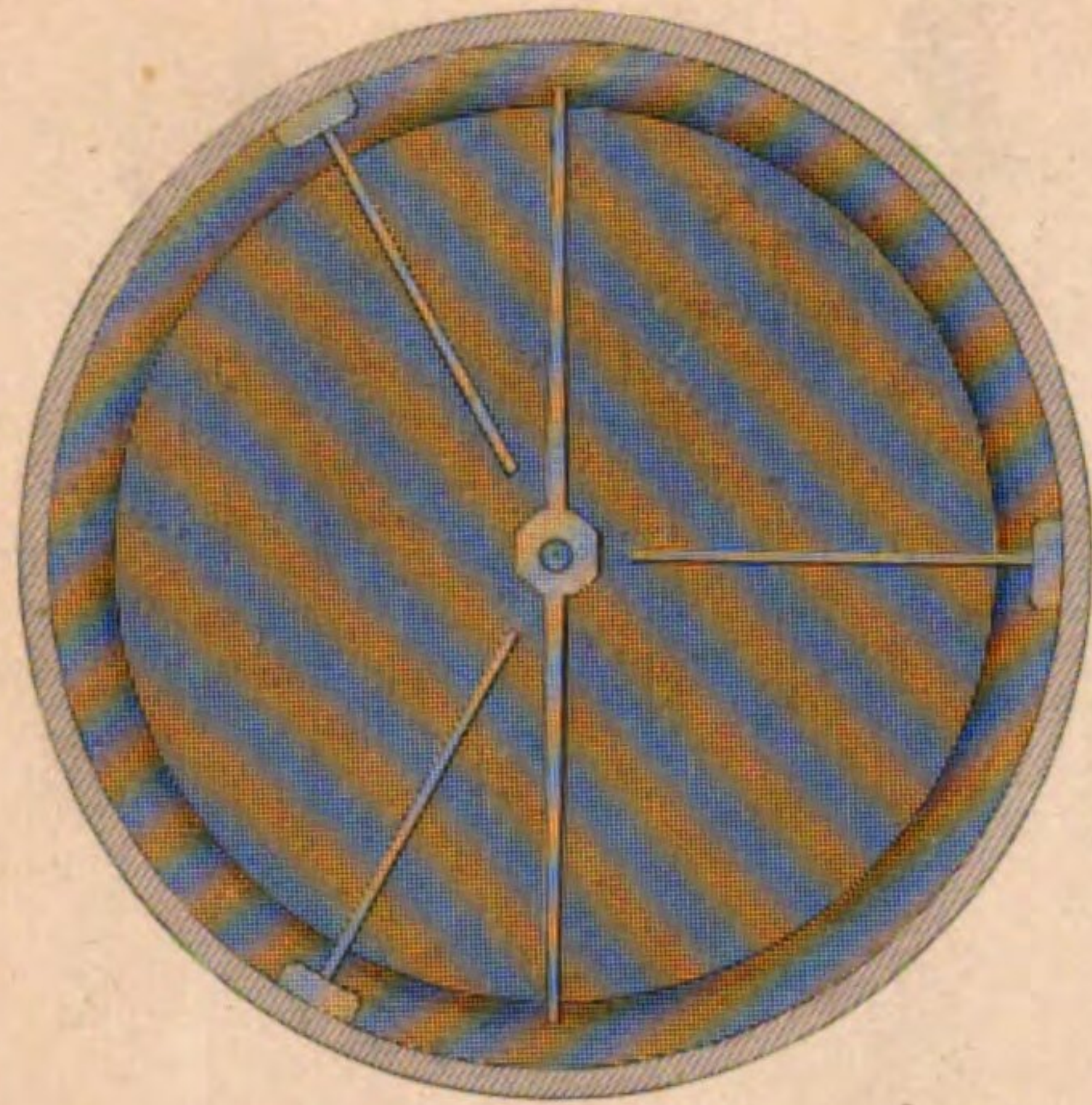


Fig. 5.
Plan of Padding Machine.

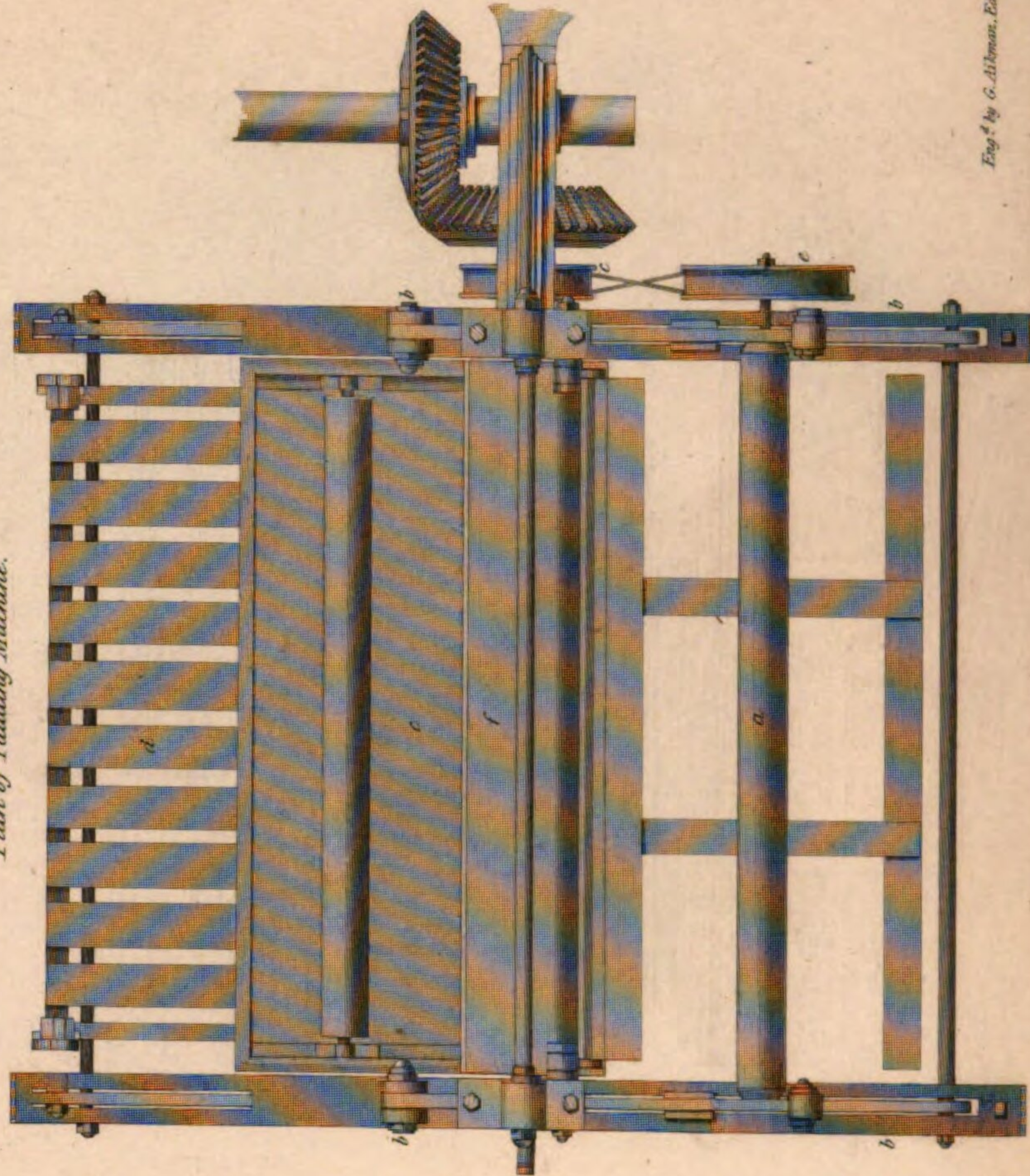


Fig. 4.
Front Elevation of Padding Machine.

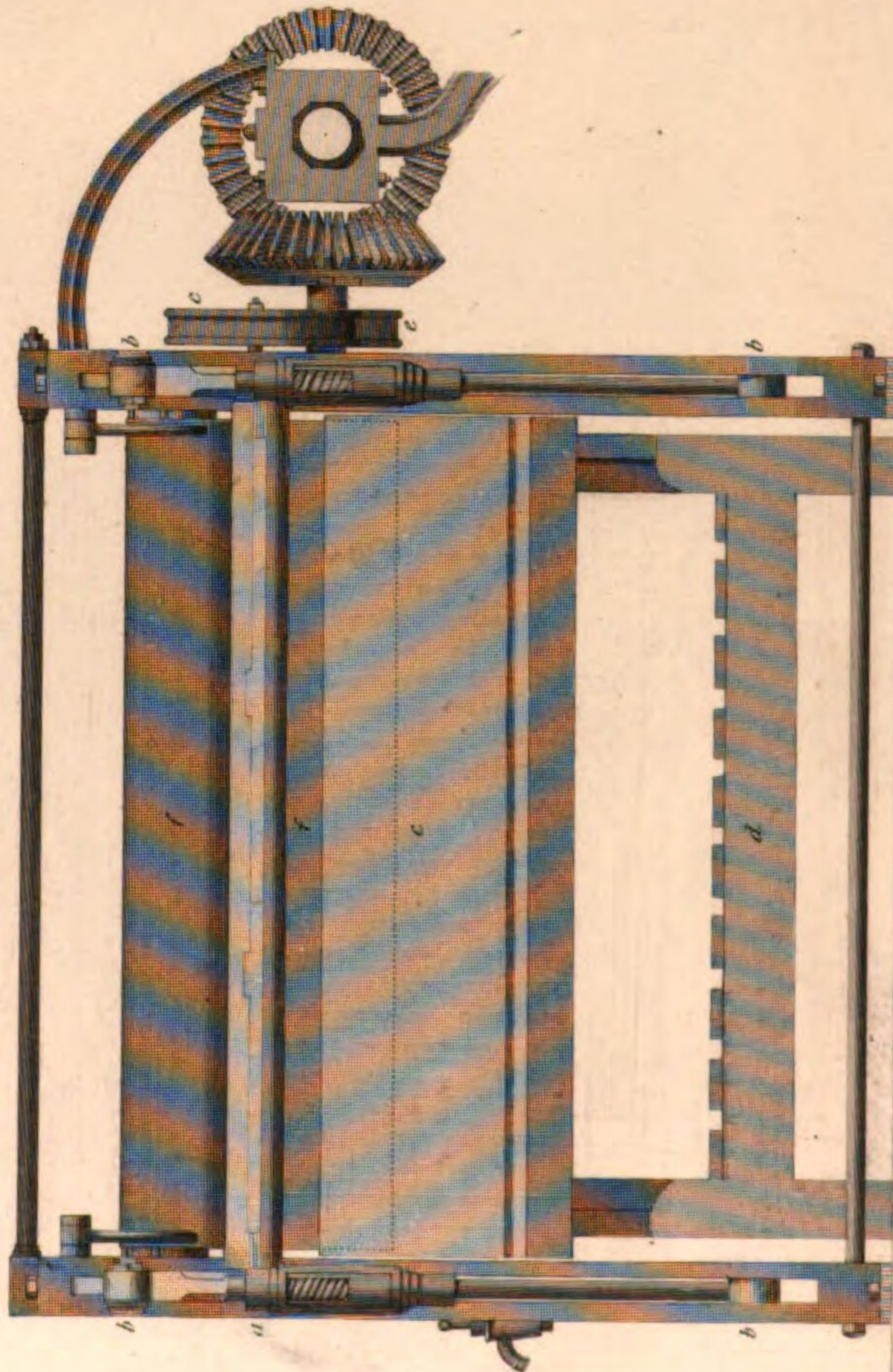


Fig. 6.
Elevation of Dyeing Bar.

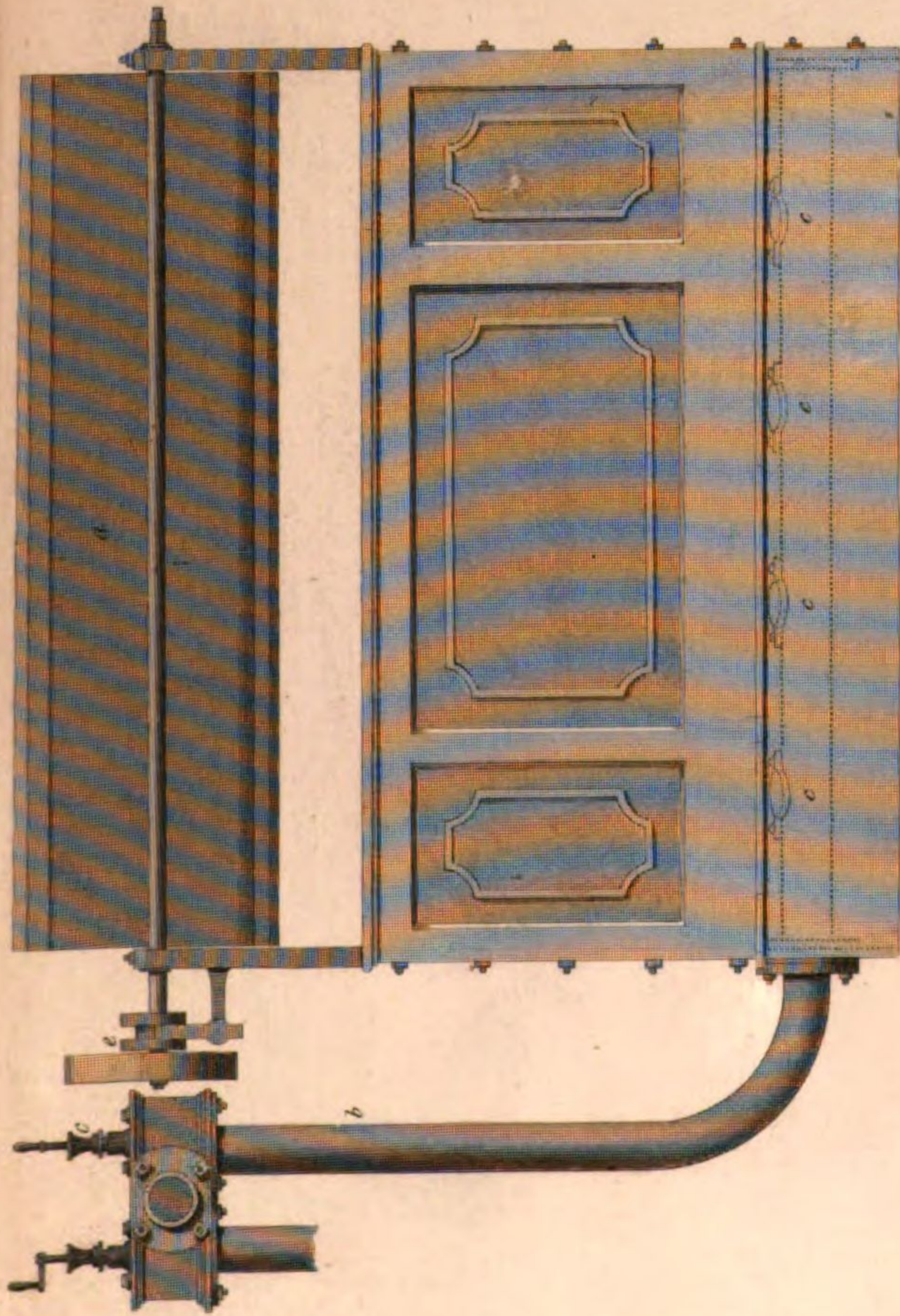
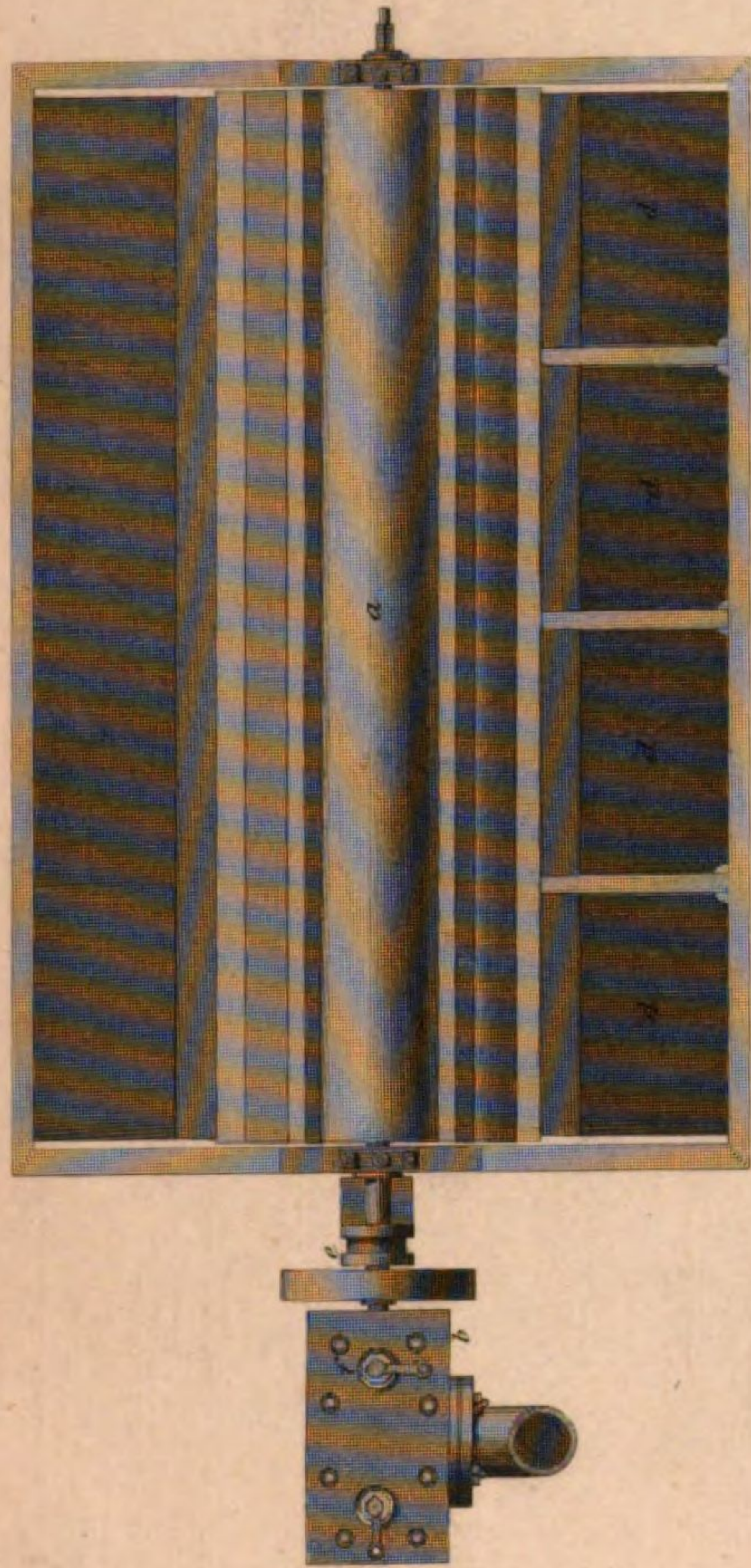


Fig. 7.
Plan of Dyeing Bar.



Section of Clearing Boiler.

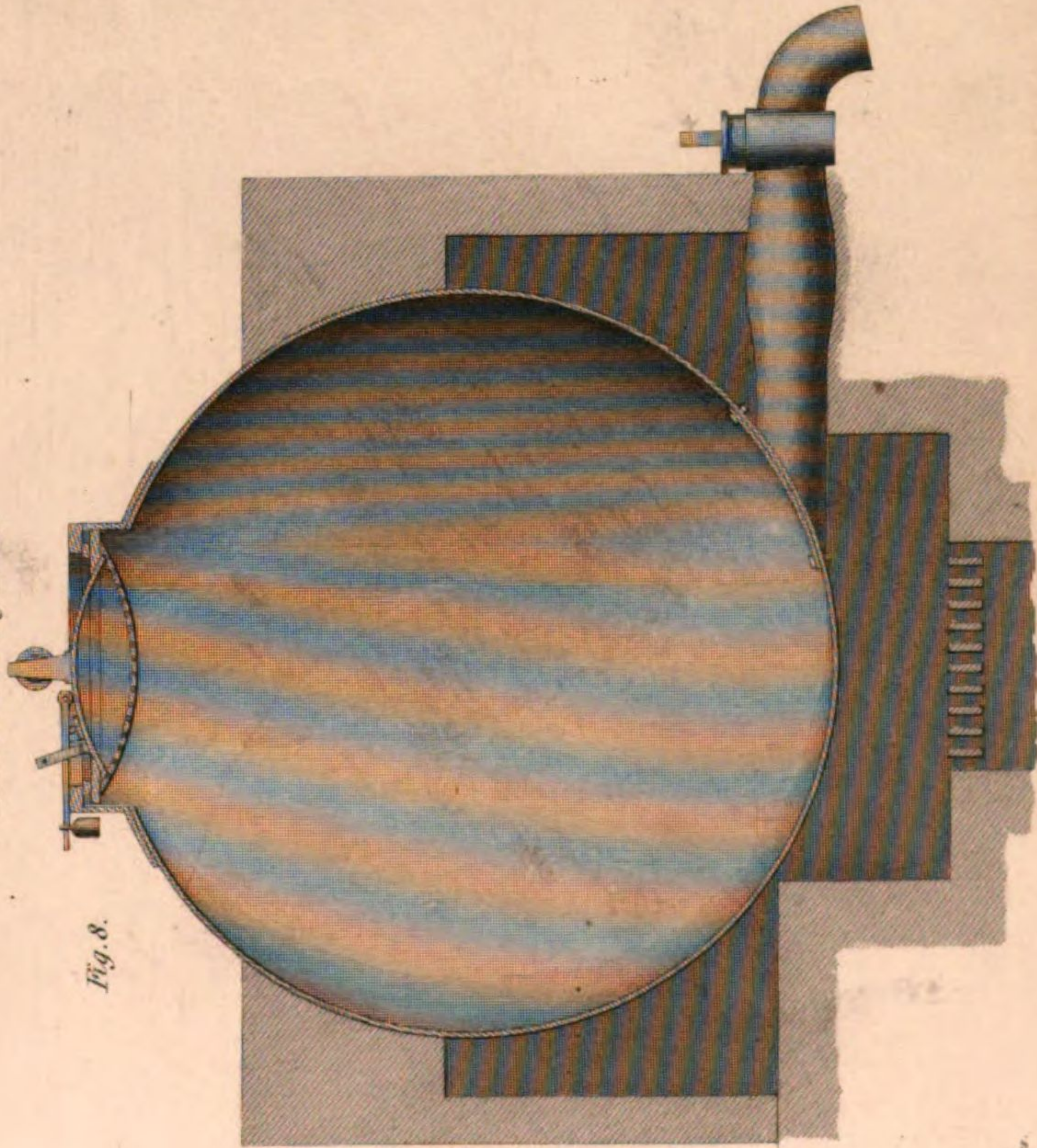


Fig. 8.

Fig. 9.
Elevation of Clearing Boiler.

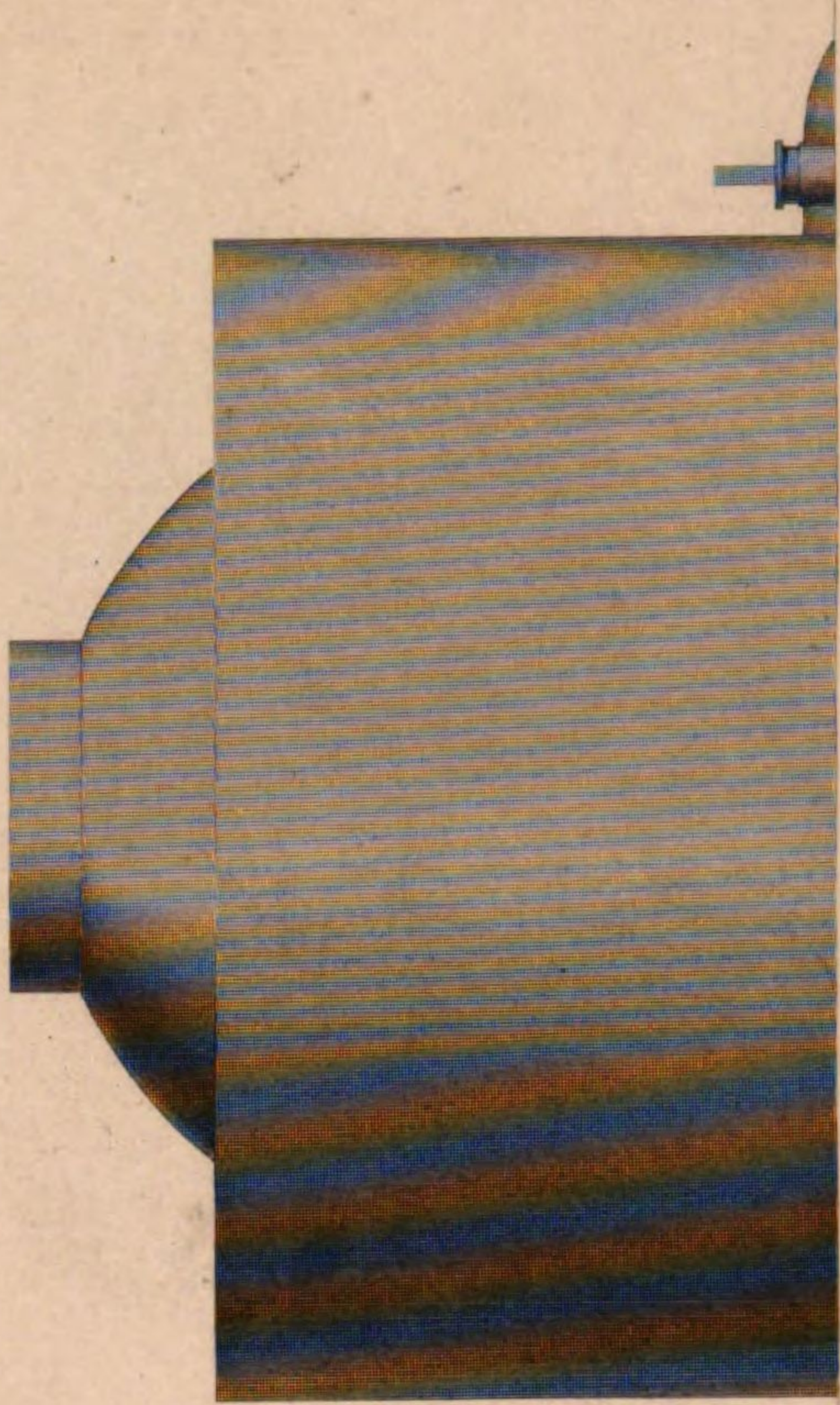
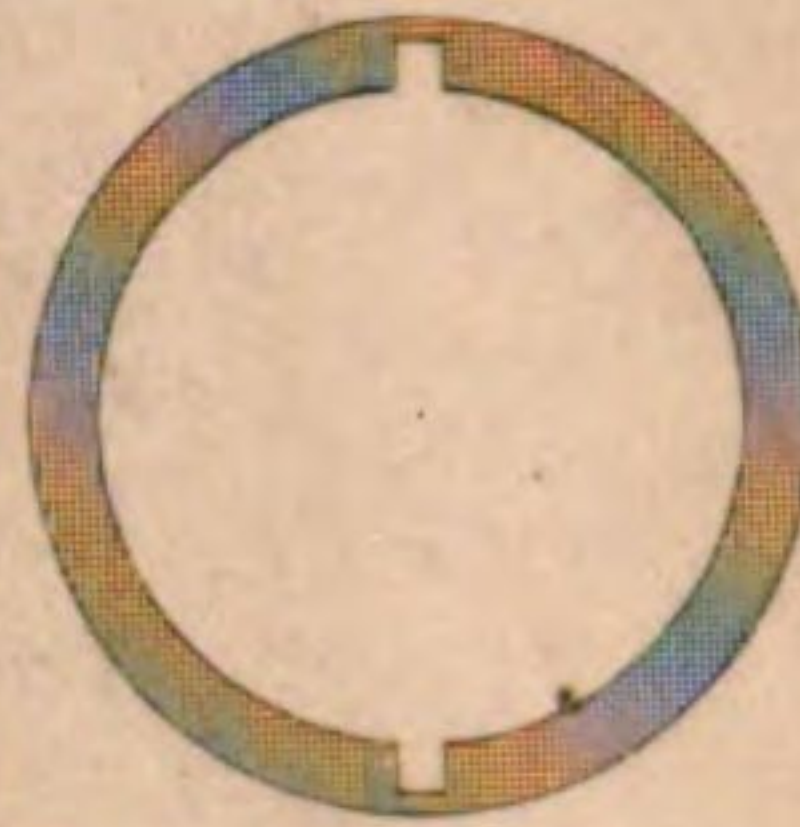
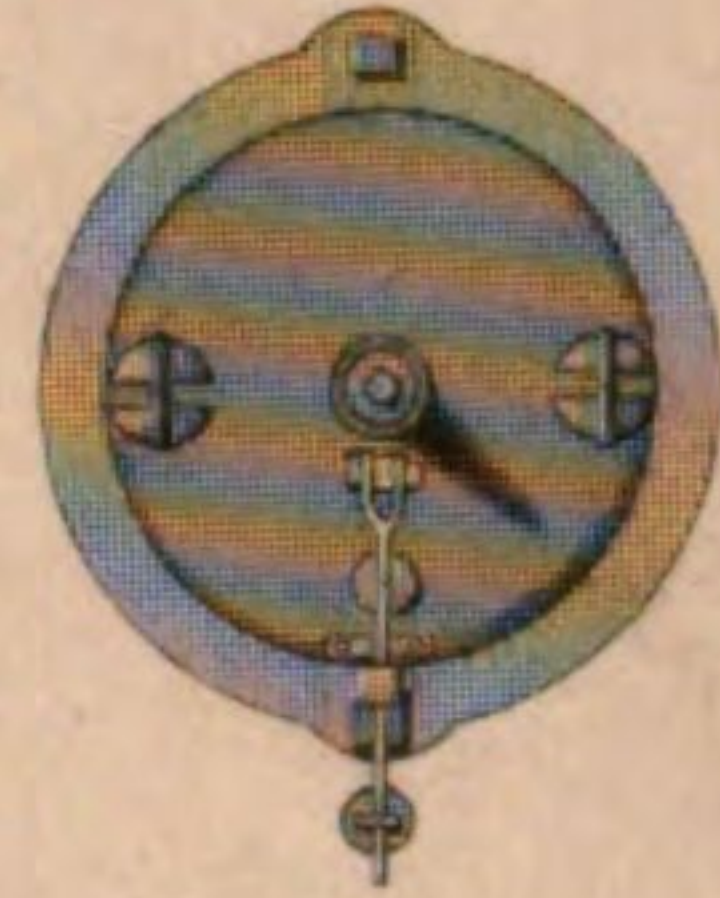


Fig. 10.

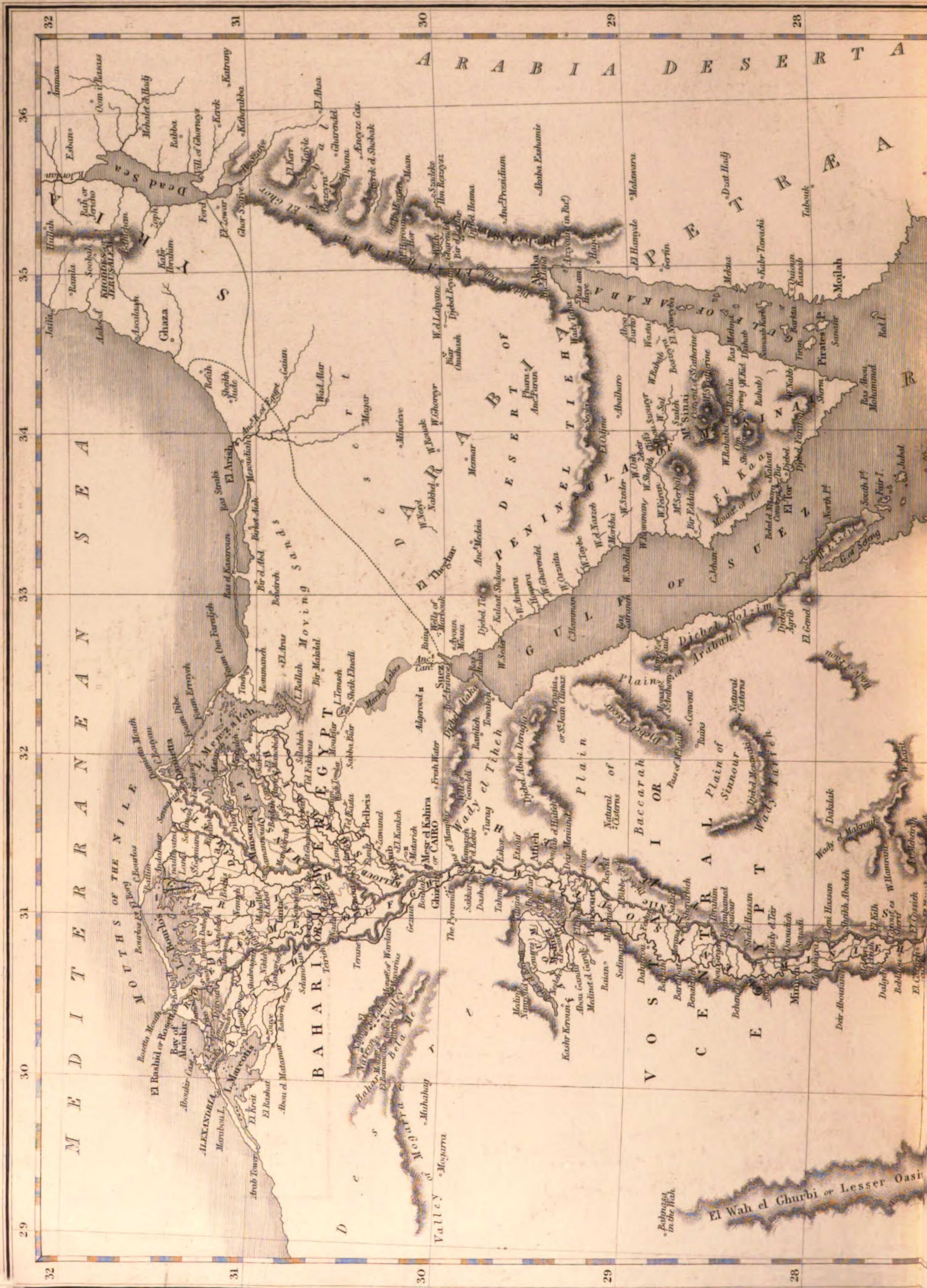


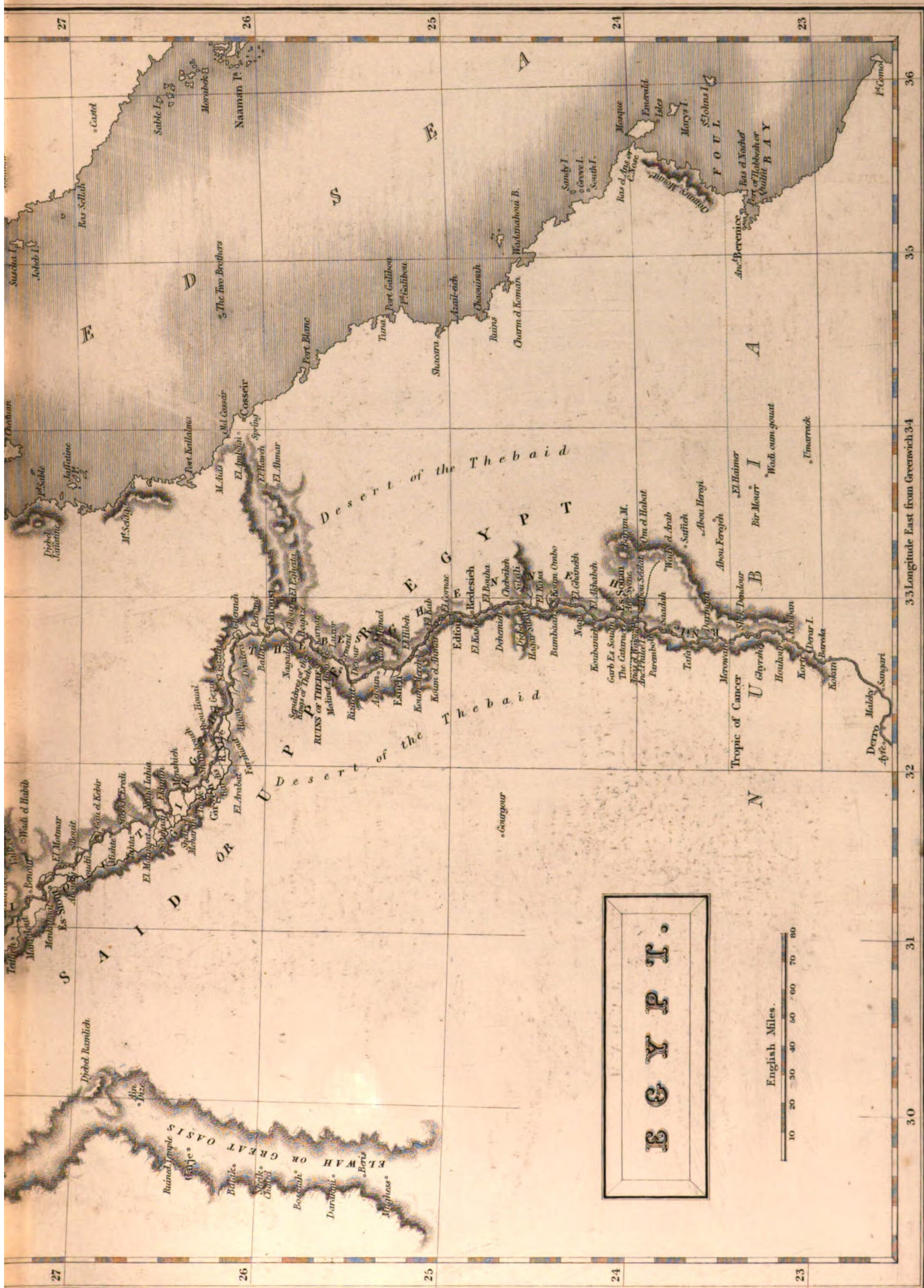
Plan of Boiler Top.

Fig. 11.



Plan of Cover.





HIEROGLYPHICS.

A. DEITIES

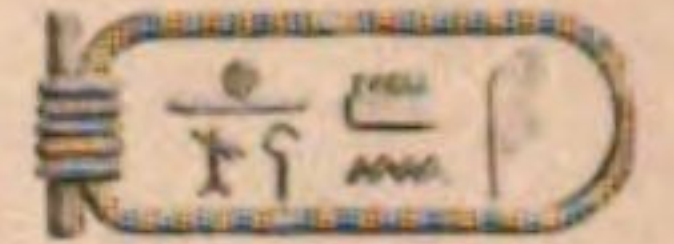
Sacred Ch.

Ros. Ench. M.S.

18 PAAMYLES



36 Tithous



1 GOD *powerful*
NOY†



1, 110 1, 1

20 APIS



38 MEMNON
AUENW†

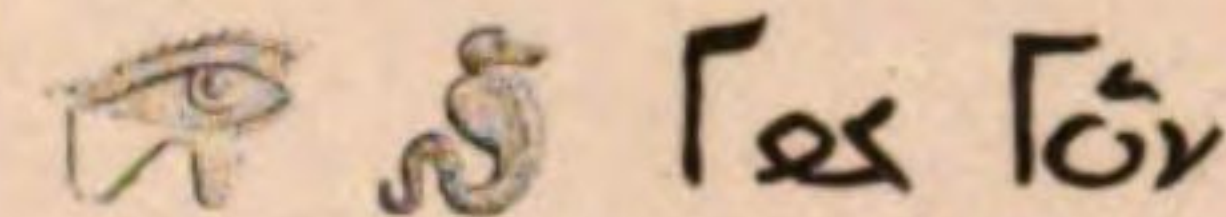


2 GOD *judge*



6, 111 1, 11

21 MNEUIS



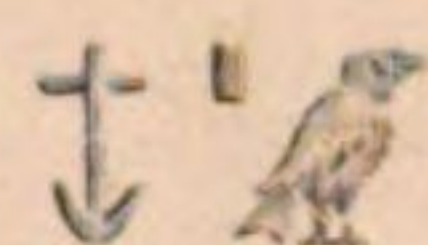
39 Amenses



3 GODDESS
†NOY†

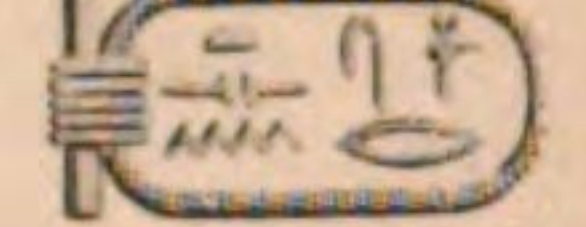


22 Hyperion



1, 110

40 Heron



4 GODS
2ANNOY†



2, 111 2, 111

23 Cteristes



1, 110

41 Remesses



5 Agathodaemon
15NOYQ†?



24 Tetrarcha

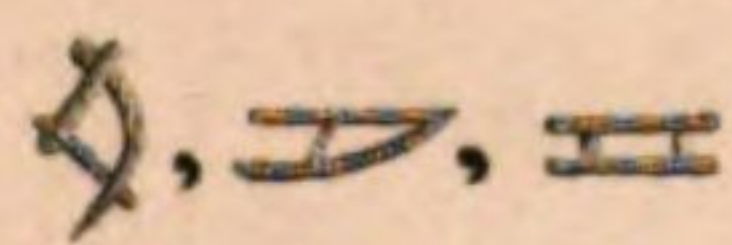


1, 110

42 Sesostris



6 PHTIAH
HT&2



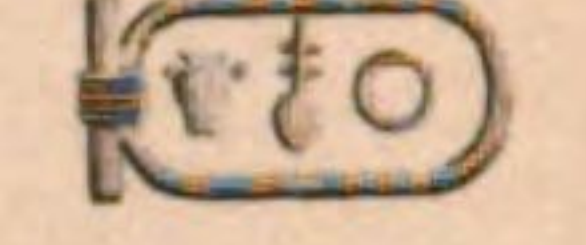
1, 110 1, 110

25 ANUBIS



1, 110

43 Pheron



7 AMMON
AUOYN



1, 110

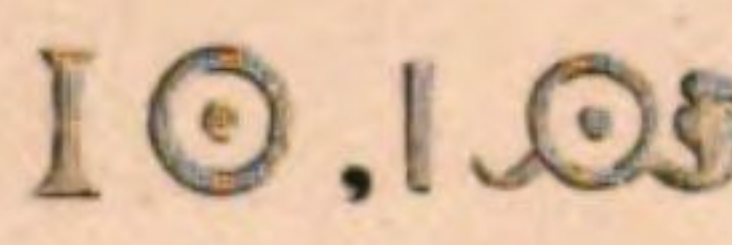
26 MACEDO



44 Nuncoreus



8 PHRE
†PH



1, 110 1, 110

27 Hieracion



45 Proteus



9 RHEA
††††



1, 110

28 Cerexochus



1, 110

46 Amaenuphthes

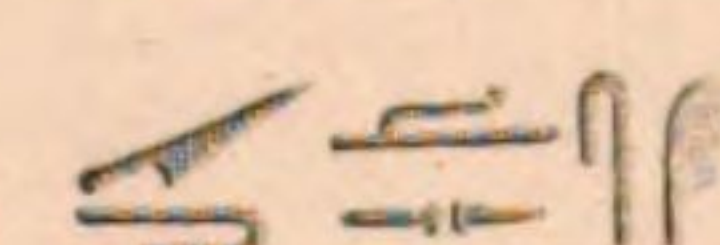


10 IOH
11002



1, 110

29 Bioxiphus



1, 110

47 Anysis



11 THOTH
θωθγθ



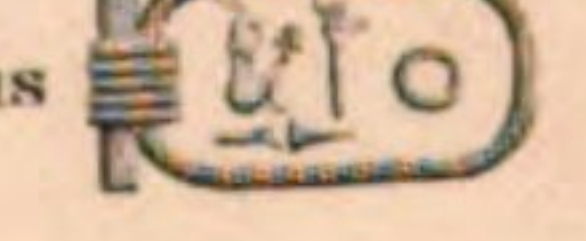
1, 110 1, 110

30 Platypterus



1, 110

48 Psammetius



12 OSIRIS
osyri



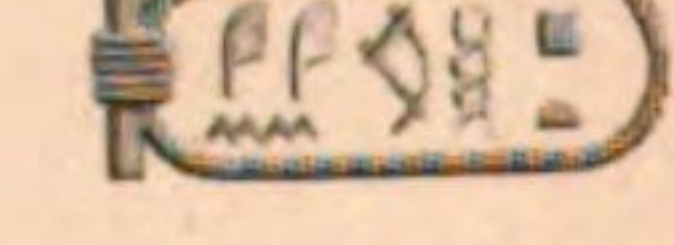
1, 110 1, 110

31 Mastigias



1, 110

49 NECHAO



13 ARUERIS

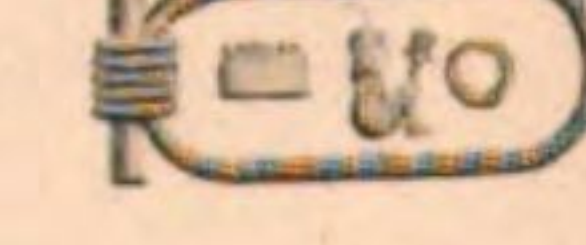


1, 110

32 Soraea



50 PSAMMIS



14 ISIS
HCL, θECI?



1, 110 1, 110

B. KINGS.

15 NEPHTHE



1, 110

33 Thuthmosis



52 AMASIS



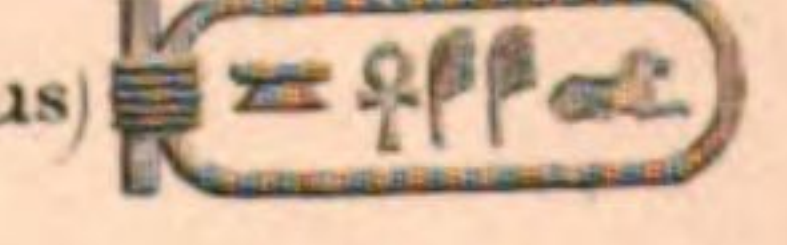
16 BUTO



34 Mesphres



53 (Ptoleberius)



17 HORUS
θωpcnci?



1, 110

35 Misphegim-
thosis



54 (Discozygus)



HIEROGLYPHICS.

55. ALEXANDER ΑΛΕΞΑΝΔΡΟΣ	ΚΞΖΖΖΖΖΖ	73. A MAN ἄνθρωπος	ἄνθρωπος	89. HABITATION οἶκος	οἶκος
56. PTOLEMY ΠΤΟΛΕΜΑΙΟΣ	ΠΤΟΛΕΜΑΙΟΣ	74. HIM αὐτός	αὐτός	90. THRONE θρόνος	θρόνος
57. SOTERES	ΣΟΤΗΡΕΣ	75. BULLOCK βούβης	βούβης	91. COLUMN στήλη	στήλη
58. BERENICE	ΒΕΡΕΝΙΚΗ	76. RAM κόριον	κόριον	92. DIADEM διάδημα	διάδημα
59. PHILADELPHUS ΦΙΛΑΔΕΛΦΟΣ	ΦΙΛΑΔΕΛΦΟΣ	77. ANTELOPE αγριόλεπρος	αγριόλεπρος	93. ORNAMENTS στολισμός	στολισμός
60. ARSINOE	ΑΡΣΙΝΟΗ	78. TORTOISE χελώνα	χελώνα	94. SHIP πλοῖον	πλοῖον
61. EUERGETES	ΕΥΕΡΓΕΤΗΣ	79. BASILISC βάσιλις	βάσιλις	95. SPEAR σπῆρμα	σπῆρμα
62. PHILOPATOR ΦΙΛΟΠΑΤΩΡ	ΦΙΛΟΠΑΤΩΡ	80. EGYPT Αἴγυπτος	Αἴγυπτος	96. BOW βόξ	βόξ
63. EPIPHANES	ΕΠΙΦΑΝΗΣ	81. MEMPHIS Μεμφίς	Μεμφίς	97. ARROW βέλος	βέλος
64. PHILOMETOR ΦΙΛΟΜΕΤΩΡ	ΦΙΛΟΜΕΤΩΡ	82. RIVER ποταμός	ποταμός	98. CENSER σπονδυλίσκος	σπονδυλίσκος
65. Cleopatrides	Κλεοπάτρα	83. GREEK Ἕλληνας	Ἕλληνας	99. BIER τάφος	τάφος
C. PRIVATE PERSONS.		84. COUNTRY χωράριον	χωράριον	100. TEAR δάκρυον	δάκρυον
66. AETUS	Αἴτος	85. LAND χωρὶς	χωρὶς	101. IMAGE εἰκών	εἰκών
67. PHILINUS	Φιλίνος	86. STAR αστήρ	αστήρ	102. STATUE εἰδωλόν	εἰδωλόν
68. DIOGENES	Διογένης	87. TEMPLE ἱερόν	ἱερόν	103. LETTERS γράμματα	γράμματα
69. PYRRHA	Πύρρα	88. SHRINE ἱερὸν	ἱερὸν	104. Weight βάρος	βάρος
70. AREIA	Ἀρεία	89. HABITATION οἶκος	οἶκος	105. GOLD χρυσός	χρυσός
71. IRENE	Ἥρην	90. THRONE θρόνος	θρόνος	106. SILVER ἄργυρος	ἄργυρος
72. Rammeneus	Ράμμενος	91. COLUMN στήλη	στήλη	107. Offerings θυσίαι	θυσίαι

HIEROGLYPHICS.

F. ATTRIBUTES AND ACTIONS

108. LIFE ΩΝΩ. &21		9, C14	126. WORSHIP Ω&ΩΩE		146. ASSEMBLY Ω&1	
109. ETERNITY ENE2		9, r, r	127. FATHER 1ΩT		146. SACRED OY&Δ	
110. IMMORTAL ETON2. ENE2		9, r, r	128. MOTHER &ΔY		147. CONSECRATED ΘOYΩT?	
111. JOY 2&ΩT? p&Ω1?		9, r, r	129. SON ΩHP1		148. GIVE +	
112. POWER XOM		9, r, r	130. ATTENDANT ΔΩK? ΩΦHP?		149. OFFER EN, 1N1	
113. STABILITY T&XPO		9, r, r	131. DAUGHTER ΩEP1		150. DEDICATE T&2O?	
114. ESTABLISHED T&XPHOYT		9, r, r	132. SONS N1ΩHP1		151. LAWFUL Θ&H1	
115. STRENGTH &Δ&21		9, r, r	133. CHILD ΔOY		152. GOOD N&NE	
116. MIGHTY XOP		9, r, r	134. DIRECTOR PEGCOTEN?		153. BESTOWING ET&N2&ΩT	
117. VICTORY ΩPO		9, r, r	135. STEERSMAN PEG2E&1		154. MUNIFICENT PEGN&NEQ	
118. FORTUNE ΩΩ		9, r, r	136. ROWER PEG&OCEP?		155. GREAT N1ΩT, N&&	
119. SPLENDOUR ΩOY, OYWIN1		9, r, r	137. KING OYPO		156. OTHERS KEX&OYNI	
120. BEARING G&1		9, r, r	138. CONDITION &ΔET...		157. CALLED ETX&Ω	
121. ILLUSTRIOUS ΦEP1ΩOY		9, r, r	139. KINGDOM &ΔETOYPO		158. DECLARATION ΩY, 2ΩN	
122. HONOUR T&IO		9, r, r	140. LIBATION ΩTEN E&OΔ		159. MANIFEST ETCOYEN	
123. RESPECTABLE &Δ? &ΔΠΩ&?		9, r, r	141. CEREMONY Ω&H&?		160. NAME PAN	
124. VENERABLE N1ΩT? N&1&T?		9, r, r	142. PRIEST OYH&Δ. 2ONT		161. ENLIGHTENING PEGEPOTWIN1	
125. RITE ΠETCΩE		9, r, r	143. PRIESTHOOD &ΔETOYH&Δ		162. LOVING &Δ1, &ΔENPH1	
			144. SACERDOTAL NTE N12ONT		163. PRESERVER E&NO2E&Δ	

HIEROGLYPHICS.

164. SET UP
τ&20 'ep&T



49

181. THOYTH
ΘΩΟΥΤ



1ω

199. THIRTY
Α&Π

9.

165. PREPARE
CE&TE



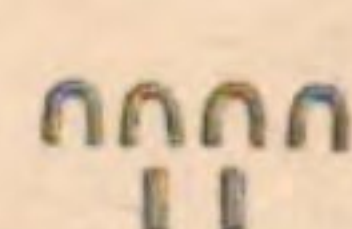
1112y?

182. MECHIR
Α&ENP



α, α

200. FORTY TWO
2.Α&E C&N&Y



11

G. RELATIONS.

166. IN ORDER THAT
2IN&



154, 2y5

184. FIRST DAY
COY&I



131

202. A THOUSAND
YD



167. WHEREVER
ΠΑ&&, EΟΥ&&&



9.5

185. THIRTIETH
COY Α&Π



10, 15

203. MCDXXVIII
YD CTD YE XOT
Y&OYN



168. AND
OYD2



912

I. NUMBERS

169. ALSO, WITH
NE&



111

186. ONE
OY&I, OYI



1

K. SOUNDS?

170. MOREOVER
N2DYD?



151

187. FIRST
2DYIT



11, 15

205
Epe

14

210
KE, KH



215
π



171. LIKEWISE
Α&A&PHT



929111

188. TWO
C&N&Y, C&N&Y



206
Aip



211
Α, ΑΑ



216
q



172. IN
DEN, E2OYN



13

189. SECOND
Α&2 C&N&Y



13

207
E



212
N



217
T



173. UPON, AT
25, E2PHI



15

190. THREE
YD&T



208
ENE



213
O&E



218
ω



174. OVER, ON
EXU



15

191. THIRD
Α&2 YD&T

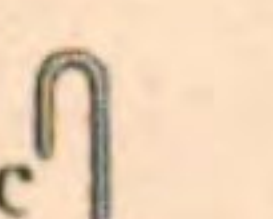


13 15

209
1



214
D&Y, DC



175. FOR
Y&



15

192. THRICE
YD&T NCOH



13 15

SUPPOSED ENCHORIAL ALPHABET.

176. BY THE
(K&T&), NTE?



25 15

193. FOUR
CTD



15 15

20, 25

D

15

177. OF, TO
NTE, N



15, 15, 15, 15

194. FIVE
TIDY



15

15, 15, 15, 15

15, 15, 15, 15

15, 15, 15, 15

15, 15, 15, 15

H. TIME

178. DAY
E2DOY, Α&EP



15

196. EIGHTH
Α&2 Y&H&N



15 15

15

15, 15

15

15

179. MONTH
Α&OT



15, 15

197. TEN
Α&HT, Α&HT



15, 15

15

15

15

15

180. YEAR
PO&H&



15, 15, 15, 15

198. SEVENTEEN
Α&ET Y&Y&G



15, 15, 15, 15

15

15, 15

15

15

My dear Mr. [Name]

I have just received your letter of the 10th inst.

and am glad to hear from you.

I am well and hope these few lines will find you the same.

I have not much news to write at present.

I am, however, very much interested in the progress of the [Project]

and hope to hear from you again soon.

I am, dear Mr. [Name], very respectfully,
Your obedient servant,
[Signature]

P.S. I have not yet received your letter of the 15th inst.

but I am sure it will reach you in due time.

I am, dear Mr. [Name], very much interested in the progress of the [Project]

and hope to hear from you again soon.

I am, dear Mr. [Name], very respectfully,
Your obedient servant,
[Signature]

P.S. I have not yet received your letter of the 15th inst.

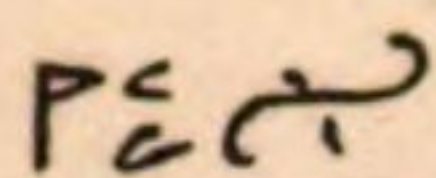
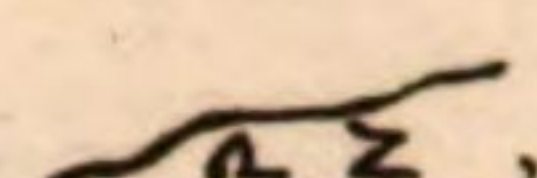
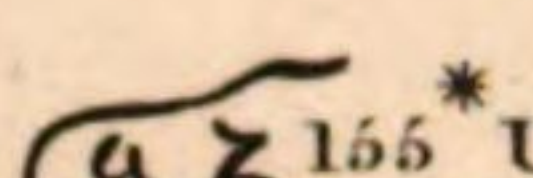
but I am sure it will reach you in due time.

I am, dear Mr. [Name], very much interested in the progress of the [Project]

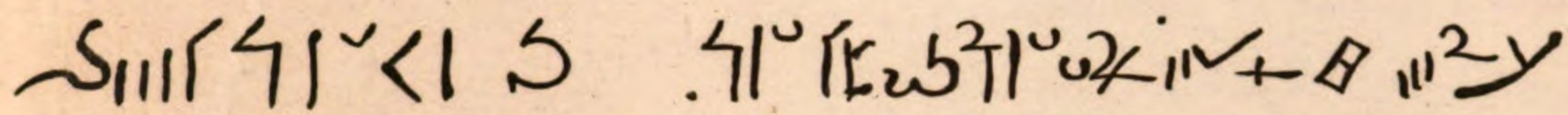
and hope to hear from you again soon.

I am, dear Mr. [Name], very respectfully,
Your obedient servant,
[Signature]

HIEROGLYPHICS.

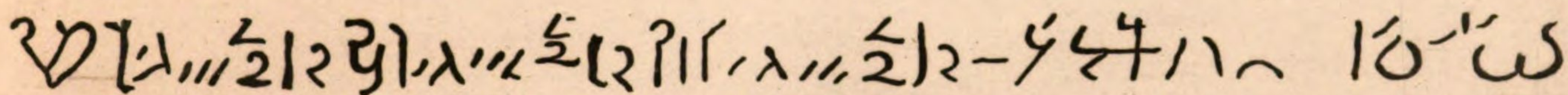
L. ADDITIONS 21 * Damalis  78 * CROCODILE a , b  166 * UPPER, LOWER 

M. SPECIMENS OF PHRASES. ROS. INSCR. LAST LINE.

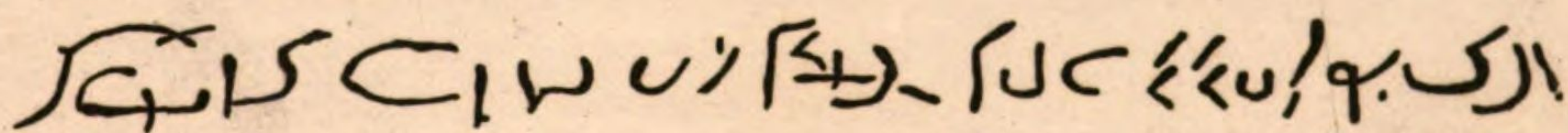
... ΣΤΕΡΕΟΥΛΙΘΟΥΤΟΙΣΤΕΙΕΡΟΙΣΚΑΙΕΓΧΩΡΙΟΙΣΚΑΙΕΛΛΗΝΙΚΟΙΣΓΡΑΜΜΑΣΙΝ



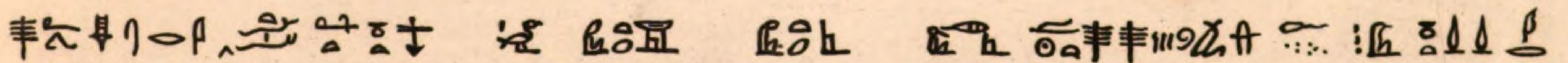


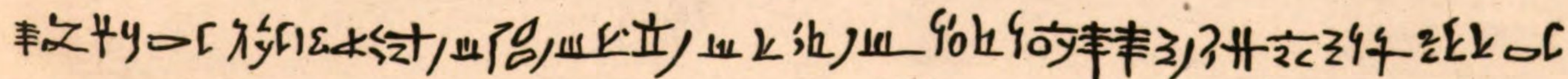
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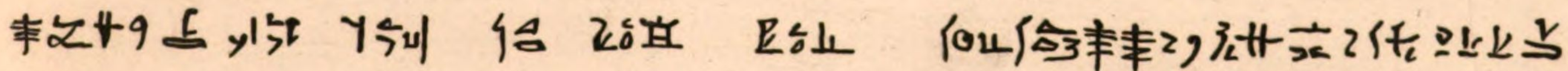


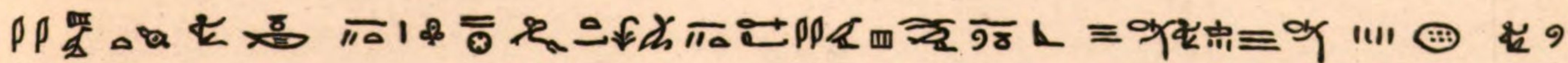


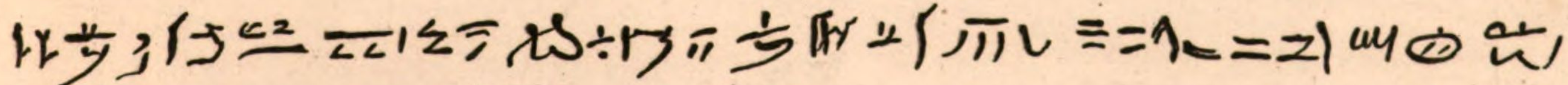
N. COMPARISON OF MANUSCRIPTS.

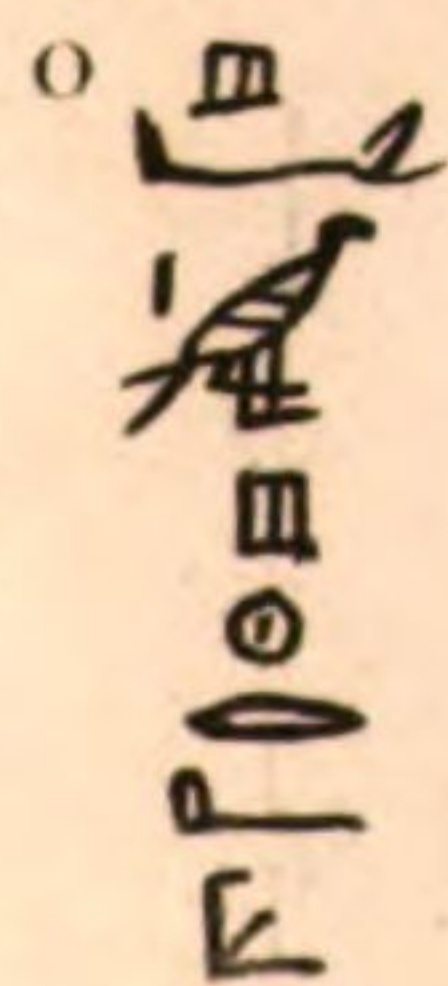








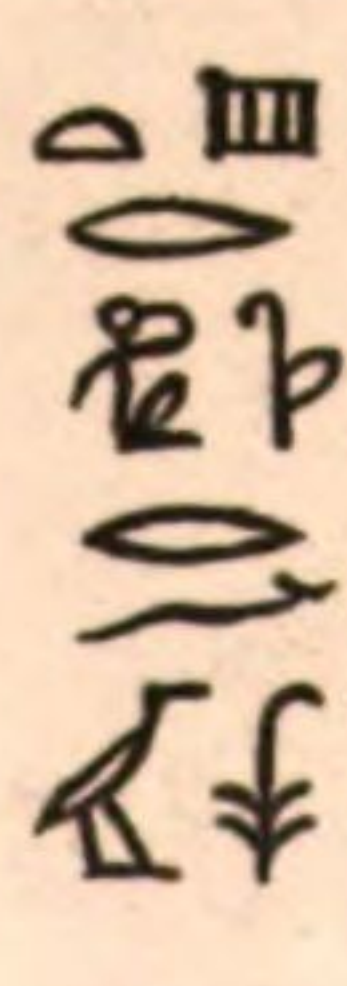


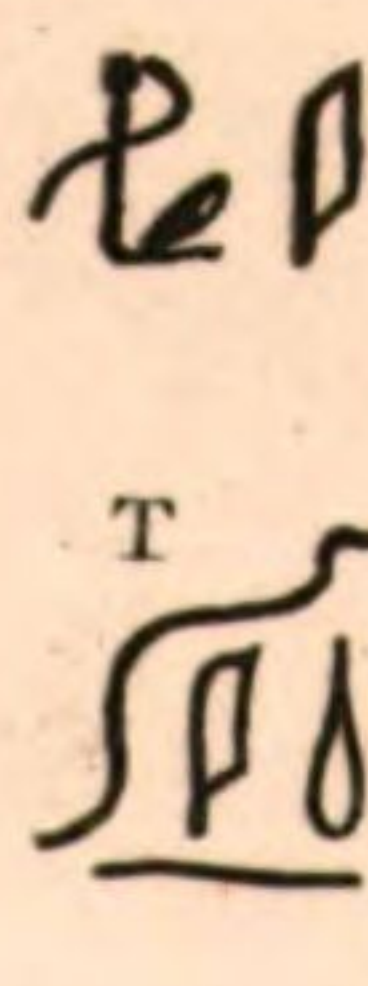
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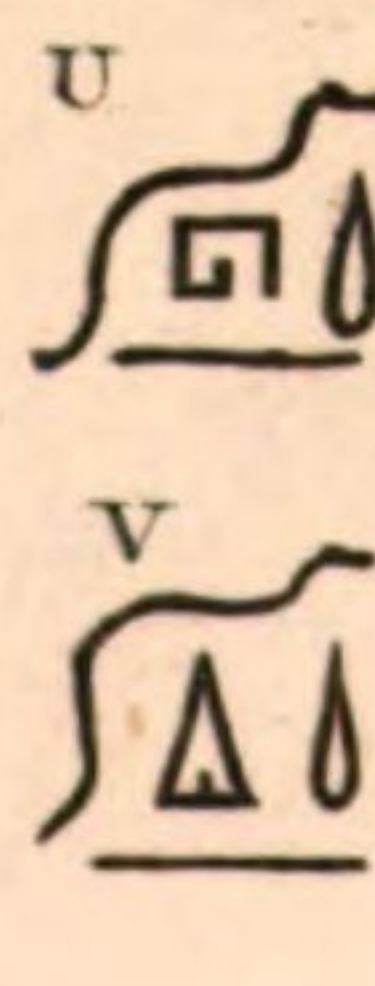
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Franz Steckeler
Buchbinderel
8984 Höchstädt/Do.

The Encyclopaedia Britannica, or Dictionary of Arts, Sciences, and General Literature

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Edinburgh (1842)

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